# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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## Improved Newspaper Printing Presses.

We present in this issue engravings of two newly improved newspaper and job printing presses, as constructed by R. Hoe & Co. The one shown on this page is named the Economy Press, and is designed to supersede the old Railway Press, built by the same establishment. It is suitable for newspapers of moderate circulation, and for neat job work, such as pamphlets, posters and books. It is very light, and can be run by hand or by steam. By hand, 700 or 800 impressions per hour; and by steam, 1,000 or 1,200 per hour is the speed at which the press can be worked without noise or jarring. This is the latest Hoe press for country newspaper work.

for power or hand, and is intended to supply newspapers of moderate circulation with a plain but good machine, on which general job work can be done. With one man at the wheel, it will work off 800 impressions per hour, and, by applying steam power, its speed may be increased from 25 to 50 per cent. It has two inking rollers, which go over the whole form. The frame is low and is bolted to a heavy bed-plate.

The type bed has holding-down plates sliding under the edge of the ribs. The cylinder is very strong, and a full-size segment, gearing into rack on type bed, insures perfect register, without slur. The finger motion is noiseless, and the fly cam has a continuous surface, so that the fly rises and falls noiselessly.

## Extracts from Chordal's Letters.

SKILL AND INTELLIGENCE AMONG MOULDERS—ART IN THE IRON FOUNDRY—THE REAL CAUSE OF POOR CASTINGS—WHAT GOOD PATTERN MAKERS STUDY—QUIRK LECTURES DOTTER ON MAKING DRAWINGS WITH SPECIAL REFERENCE TO PATTERN SHOP AND FOUNDRY.

*Mr. Editor:*

* * * * If the pattern makers and moulders keep up the discussion which has been started in the AMERICAN MACHINIST they will soon exhaust it, and be led into the discussion of a question of real merit, to wit: How can we be of service to each other? The present question seems to be: How can we best excuse our lack of co-operation? The moulder's trade is certainly entitled to some little respect at least.

Among a large number of moulders you will find many men of low intellect and little or no pride. Many such men make good castings. The foundry is a dirty place. Pig iron and scrap are rough and ugly. When a flask is closed up it is anything but beautiful. Nothing is less attractive than a casting as it leaves the foundry for manipulation by cleaners, etc. The moulder's work seems to consist of hard, heavy, rough, "laborious" work, and all things conspire, apparently, to withhold from the trade all the features which tend to give to a trade the charms of an art.

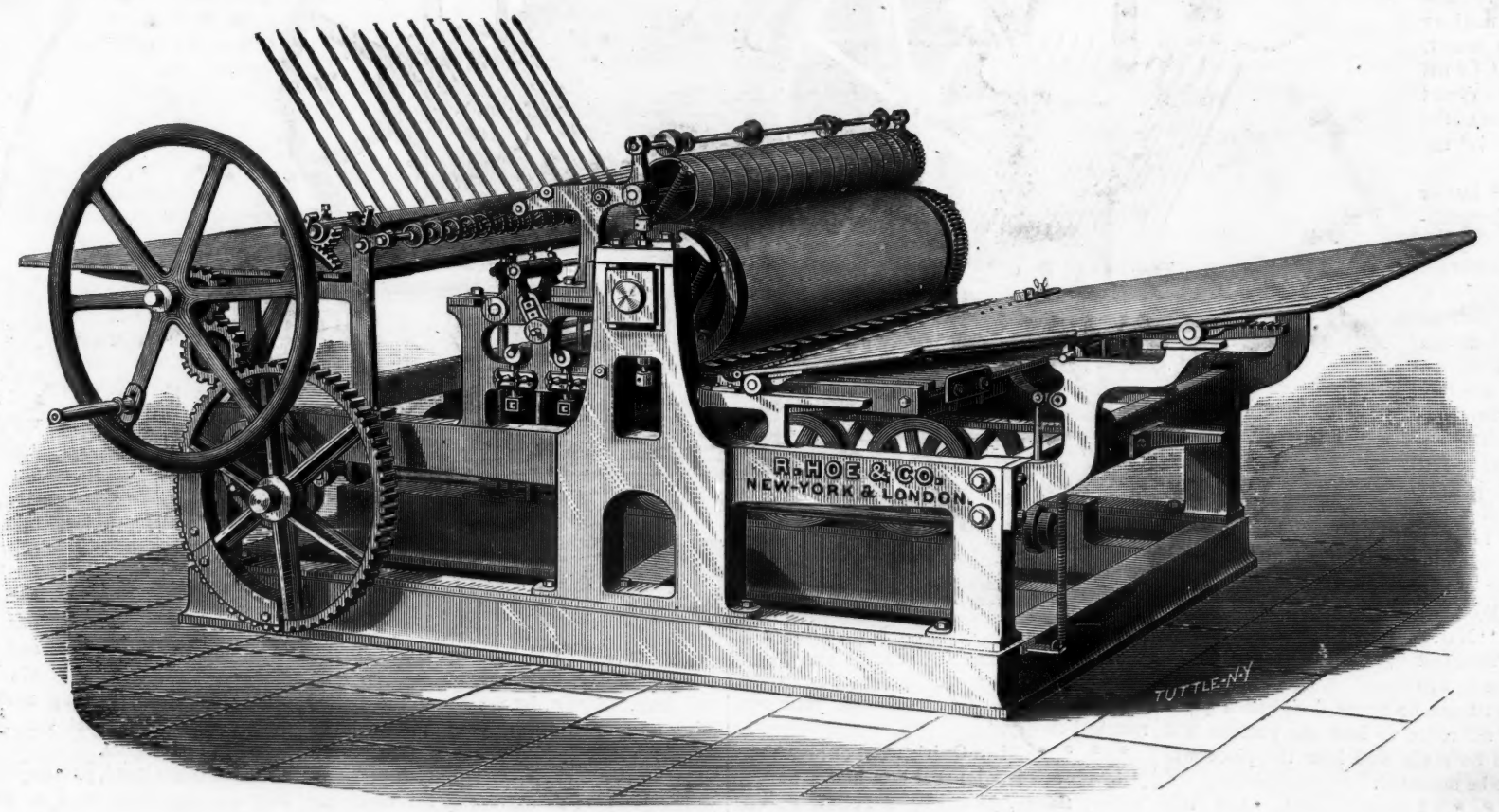
* * * * If one looks into a foundry door once in a year, such a view of the moulder's vocation might be justified; but no fair-thinking pattern maker or machinist can doubt for a minute that in the moulding room there exists a necessity for a something which is not at all akin to simple dexterity.

* * * * The foundry is just like every other shop. There are many men working in it who simply furnish force. They can jab a vent wire into a mould, but for the life of them they cannot tell whether they should jab it in or not. The real moulder—the one who should have credit for results—knows what to do, even if he cannot do it himself. If moulding was the simple dexterous muscular trade which some mechanics think it is, we would be led to believe that any man would become a moulder by simply working at the trade long enough to learn the twists.

Experience shows that not more than one moulder in five can go into a foundry, select sand, fuel, iron, wind, facing, etc., and make castings. Almost all small foundries must stop if the head man takes a week's vacation. These things indicate that there is an art in foundry work, and that the art is not by any means acquired by all the foundry workers.

There are gray-headed moulders who can not make a straight-armed pulley, and they cannot tell why they fail. There are young beardless moulders who will make straight-armed pulleys in any shop, and they know why they are able to do it. There are foundries in which no expense is spared in the selection of material, and still every important casting is a failure. In some foundries there is a permanence of mishaps, which call for a perpetual excuse. First it's the moulding sand, then the core sand, then the facing, then the last lot of pig, then the burnt scrap, then the coke, then the blast, and then something else, and so on forever. The real cause is ignorance on the part of men. There are other foundries in which the knowledge of art, and the exercise of a keen judgment make the operations of a day a certainty.

These things indicate that the art of the




HOE'S ECONOMIC PRINTING PRESS.

The bed is carried by a truck upon a railway, and is driven by a crank motion. It is what is known as a stop cylinder press. The paper is fed to the under side of the cylinder, which, after an impression is given, remains stationary while the bed returns, and the fingers close on the next sheet before it starts again. The cylinder wheel gears directly into a rack on the side of the bed, and excellent register is obtained without a pointing apparatus. The impression cylinder is not shifted to suit forms of different sizes, but the forward edge of the type is always placed on the same line on the bed.

This arrangement secures accurate register and neat clean impressions.

Some of the advantages over the Railway press are that it has a bed-plate, a new cylinder delivery, improved fountain and discharge of ink, and improved register and sheet delivery.

The press shown by the engraving on our second page is an improved style for country newspaper and job offices. It is designed

## Asking and Answering Questions.

The department of the AMERICAN MACHINIST, which, in proportion to the space devoted to it, perhaps involves a greater expenditure of time and labor than any other, is that entitled *Questions and Answers*, and a little thought will show the reason why. The object of a well conducted mechanical newspaper should be, not to do thinking for its readers so much as to stimulate them to think. Out of the great number of questions sent us for solution, some seem to be asked without reference to the fact that a knowledge of arithmetic is as indispensable to the mechanic, as food is to a hungry man. Answering questions which a little knowledge of arithmetic would enable the inquirer to answer for himself is not the object of this department. When it is considered that some of these questions have sufficed to puzzle a whole shop or neighbourhood, our readers will readily appreciate the pains and expense which their proper solution requires of us, some even involving the construction of special apparatus with which to conduct a course of experiments.

foundryman is no common one. There may be less of skill, but there is infinitely more of art in the dirty foundry than there is in the clean, light pattern shop, or noisy finishing shop.

* * * * In country shops the machinists are often called into the foundry to help during a heat, and often during a dull spell the pattern maker will go to moulding.

One noticeable thing is, that when a pattern maker goes to using his own patterns he invariably finds some tinkering to do on them. Let a pattern maker mould up one of his patterns twice, and he will take it into the pattern shop for alteration.

* * * * The best pattern makers are profound observers of foundry operations. Some pattern makers know little and care less about moulding, and what little they do know is the result of complaints from moulders.

* * * * It is the business of the pattern maker to provide facilities for the moulder. There is no other definition for the pattern maker's vocation. If a moulder could work without patterns, there would be no pattern makers.

That pattern is the best pattern which will best answer its purpose in the moulder's hands. Some moulders are so skillful that they can get along with any kind of a pattern. Any plug of a pattern maker can suit such moulders. The pattern maker must be smart, observant and skillful in direct proportion as the moulder is unskillful.

* * * Dotter was a draughtsman, and Quirk was a retired superintendent, who had been all the way through the mill.

Quirk one day leaned over Dotter's drawing board and asked if he kept the pattern shop and foundry in view all the time while designing a machine. Dotter said "No." Quirk remarked that when he was at the business he never designed a piece without reference to how the pattern was going to be made and how the piece was going to be moulded.

* * * * I was present when this occurred, and knowing that there was a great deal in the question involved, I urged the discussion forward, and set the parties to making speeches at each other.

Said Quirk:—"A draughtsman may, by the exercise of a very little judgment, so arrange his design that the labor of the pattern maker and moulder may be very much reduced. He would not, for an instant, think of designing a piece of work without knowing exactly whether and how his ideas were to be executed in the blacksmith shop and machine shop. You would never think of calling for a chambered forging on ordinary work, because it is almost impossible to do such forging. Nor would you call for lathe work on a job which a lathe tool could not reach. If you want a hole in an inside partition you always satisfy yourself that a drill can be made to reach the spot. If it can't, you alter something till the job is one capable of practical and economical execution. When you design unforged wrought work, you have reference to metal found in the market. You might design a boiler, and show by calculation that the plain head would be best if an inch thick at the center and three-eighths thick at the edges; but you know very well that iron is flat, so you use flat iron and get the strength by bracing. You have, right there on your drawing, an outer pillow block for a portable engine; it is very pretty and correct and all such, but I want you to tell me how you are going to lay out the pattern, and how you are going to mould it? Could you not alter it so it could be more easily done? I am not criticising your pillow block, mind you; I simply use it in illustration."

Then Quirk looked at the drawing closely and estimated some. He continued, "I can see how the thing can be made, but I can also see that it will require a great deal of skill, and figuring on the part of the pattern maker. I don't believe the pattern maker lives who can make that pattern inside of four days. That will make the net cost of the pattern twenty dollars, and it will be troublesome to make.

* * * * Then said Dotter:—"Go ahead and use the pillow block for an example as long as it will answer. I consider your estimate of twenty dollars a correct one, and the matter of trouble and skill and time don't enter the question so long as we have the requisite skill and time. The twenty dollars pays the whole bill, and that is all we must look at. Go ahead with your economical theory."

* * * * Then Quirk went on:—"Your pillow block is a journal box and a curved bolting flange, joined by a hollow curved box arrangement. It looks exactly right, but you must notice that everything sets at an angle with everything else. This makes the job difficult and puzzling for a pattern maker. I see you have here a cut of one of my old engines, and I take its pillow block for an example without any invidious comparisons. We will assume that you, and not I, designed it. Notice that the relation of the journal box to the boiler is the same in both cases. In the new case you have a single beautiful piece of impossible shape, while in the old one there is a simple shelf bolted to the boiler, and on this shelf is bolted a simple plain box. That shelf pattern is made of three pieces of wood of the simplest shape. It is no trouble to make. The box is just like any other box. The planing and drilling is a simple, common, every-day shop job which will bother nobody. I believe the patterns complete can be made in two days, or at a cost of ten dollars. There you have a saving of ten dollars on a little pattern which will almost go in your pocket. What have you to say to this?"

Then Dotter said this:—"The pillow blocks are excellent examples. The old one looks as if it was designed with special reference to a pattern shop and foundry, instead of to a portable engine. It has two flanges, two planed surfaces, and four bolts, which the engine don't want, but which you think the pattern shop and foundry do want.

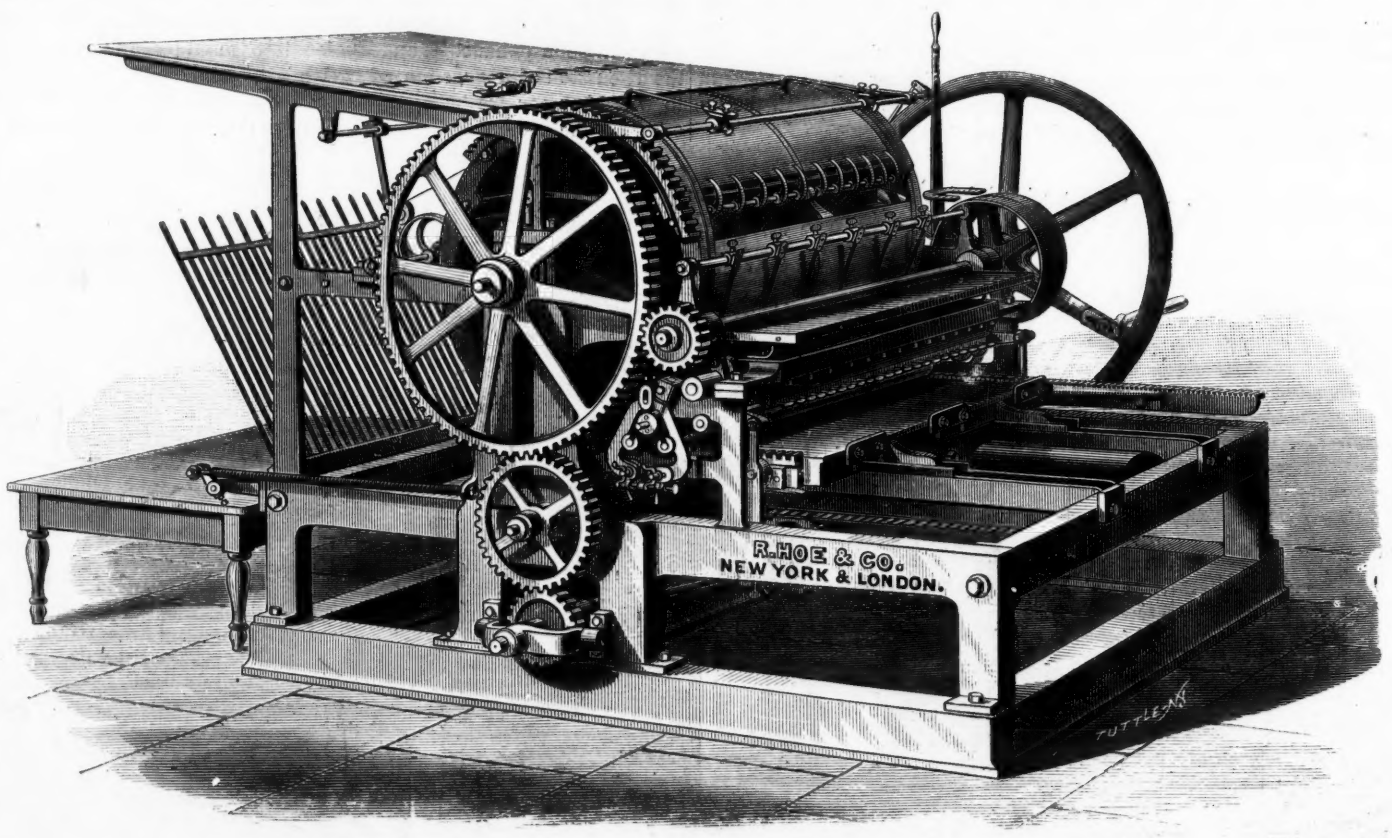
"Our two pillow blocks have exactly the same function and are the same size. You say mine is handsome. It is handsome only because it is correct, and has no special pattern shop and foundry superfluities about it. Aside from that we will assume that it is just what I want anyhow.

"Now you ask me how I am going to mould it. I answer that I am not going to mould it at all. It will be moulded by a moulder, and I expect the casting to cost me no more per pound than if in your shape. My experience is that the price of castings is not enhanced by giving to them new and more correct forms. As far as difficulties are concerned, I care nothing for them, except as they involve money, and, as I said before, such designs do not seem to have any appreciable effect on the price. The dead level of experience seems to govern this matter without any special attention during design. When I design a piece of work I give no thought to sand and cope and drag. Again, by reason of the bolted joint and open form, your pillow block weighs eight pounds more than mine. This, at three cents, is twenty-four cents, which you give as extra pay for moulding a piece of specially designed simplicity. Remember this figure.

"In regard to the pattern, I would say that I do not make the pattern, and I do not care how it is made, so long as it makes a casting of the shape I want. I never yet drew anything which a pattern maker couldn't make, and, in a general sense, I don't care how much trouble he goes to. I do want to know what the pattern will cost, and I assume that the cost covers the trouble. You have figured some, now listen to me. When these patterns are done, we intend to build at once four hundred engines from them. I acknowledge to squandering ten dollars extra on this one pattern. With your cheap form of pillow block, there will be four hours planing and half an hour's drilling on each one, in order to carry out the idea of a trouble-saving joint. Four five-eighth bolts will cost twenty cents; bolting together will cost five cents. See what all this amounts to. Extra iron, twenty-four cents; planing and drilling, one dollar and a half; bolts, twenty cents; bolting, five cents; total, one dollar and ninety-nine cents per engine, or seven hundred and ninety-six dollars on the engines we intend building this season. I call the saving of this a tip-top return on an investment of ten extra dollars. This is saying nothing of the fact that the pillow block is the correct thing when done. The pattern shop is the last place to economize. Pattern work is done but once, while its products may be multiplied by thousands, in which case an ounce of iron saved at a pattern cost of five dollars is good business. When it comes to the duplicating processes of the blacksmith shop and machine shop, the case is different. Details of process to be often repeated, must be kept in view. In the foundry, as I have said, the design has little effect on the cost per pound of average machine castings." * * * *

Very respectfully,

CHORDAL.




IMPROVED NEWSPAPER AND JOB PRINTING PRESS.—See Page 1.

## Pumping Machinery.

No. I.

BY CHAS. A. HAGUE.

The designing and constructing of pumping machinery seem to combine, in one undertaking, all the difficulties and conditions embodied in several distinct lines of mechanical engineering. There is a demand for careful, reliable observation—the ability to first comprehend correctly the nature of effects, and then, tracing backward, find their cause. In many cases a full comprehension of a difficulty will suggest the remedy at once: but it often happens that we are unaware of our position in the scale of cause and effect. That which was looked upon yesterday as a final conclusion, and to attain which every effort was put forth, is found to-day to be only one more step; and other conclusions, and other steps are a pressing necessity, immediately we reach what was formerly supposed to be the goal.

On the other hand, a retrograde movement may be expedient, and a difficulty into which we may have run can only be avoided by retracing carefully the path once eagerly pursued, until a point is reached which, like a fork in the road, will open a way that promises better results.

In constructing pumping machinery, the object in view is to "elevate water." But before the task can be accomplished which this simple declaration sets forth, what a multiplicity of problems must be solved!

Economy is the great demand to be satisfied, and even this is only a comparative term, for it is governed entirely by the conditions which surround each particular undertaking.

Economy is the science of securing the greatest amount of the object in view at the least possible expense; and the principal risk is in making a mistake as to the true nature of the object in view, and the exact bearings of the expense accounts. As we have seen, the object in view in the use of pumping machinery is the elevation of water, and the items of expense are: interest on cost of apparatus, fuel, repairs and attendance.

The "duty" may be high, but the first

cost may also be high; so that the clipping of coupons from water bonds may result in clipping quite a margin from the fuel credit; from which it would seem that a somewhat lower duty would be admissable, if the interest on the investment was materially reduced. In a majority of cases where cities and towns sell bonds and buy pumping engines, the chances are that the bonds will live as long as the engines, or until the engines need to be so thoroughly overhauled, or so nearly rebuilt, that the corporation will never be relieved from paying interest on its machinery. Or even if the bonds are finally retired, any great difference in amount of interest to be paid during twenty or forty years, as the case may be, should be well considered in selecting pumping apparatus. Where a stock company engages in the water business—to supply a city and own the plant, the payment of interest on the capital invested would be perpetual.

In cases where extremely high duty is attained, the items of repair and general expense are liable to follow the duty; so that, after carefully looking over the ground, it behooves the designer to seek for a happy medium in which all the factors receive their fair share of attention, and no single item, however important in itself, is raised above its proper rank to an extent that will endanger the quality of the general result.

From the idea of elevating water, the mind is naturally led to a consideration of the instrument by which the fluid is to be moved; and in the effort to adapt the pump to its work, the suggestion immediately comes to study the nature of the fluid itself, and ascertain the conditions which surround the task of moving it.

We find that water is inelastic to an extreme degree, and consequently does not readily adapt itself to a varying rate of motion, but tends to go straight ahead at uniform speed. In proportion to its volume its gravity is considerable. It therefore requires momentum, and an attempt to turn it suddenly from its course results in friction and discomposure of the mass. The rapidity with which it will flow into a vacuum is found to be limited by its ability to change its form quickly, to suit the shape and number of the passages, through which it is forced to pursue the receding piston. One annoying feature of this operation is that if the piston moves too fast, it will reach the end of its travel and begin to return before the water can fill the empty space; and when this occurs, the shock resulting from the meeting between the moving masses of metal, and the column of inflowing water, is transmitted to the machinery in one direction and to the valves of the pump in the other, seating the suction valves with a thump that would seem to threaten their speedy destruction. Accompanying the effect on the suction valves, it will be found that the discharge valves are opened with a jerk, and the concussion transmitted to the entire delivery portion of the pump, and also to the force main. The pump must suffer loss of capacity under such circumstances, by reason of the unemployed volume swept through by the piston, and by the expulsion of a portion of the water through the suction valves before they can be seated; and this feature brings us immediately to the consideration of valves and water ways.

The student of pumps, when speculating on valves, finds himself surrounded by a complexity of conditions that requires some very fine judgment and some very extended experience to enable him to perceive through the maze the path to correctness and success. If the whole end of the pump could be removed at the beginning and replaced at the end of each stroke, the maximum of capacity and speed, and the minimum of friction and discomposure, in getting the water into the pump, would be obtained.

To decide how near in effect to this desirable accomplishment it is possible to reach becomes the all-important problem, in regard to valves and passages, and, after arranging these to the best advantage, the matter at last resolves itself into a question of piston speed.

This complete filling of the pump cylinder would check the current, so that the suction valves, if properly situated, would drop to their seats without shock, and furnish the driving power with a full load at the commencement of the stroke, thereby avoiding the secondary shock to the delivery column.

An indicator diagram from a correctly-working pump, should be a rectangular parallelogram, whose vertical lines exhibit how completely and instantly the engine takes up the full load at the commencement of the forcing stroke, and how promptly the water is enabled to defeat the attempted vacuum at the beginning of the suction stroke; whose top line, above and parallel with the atmospheric line, shows the pressure due to the height of the head of water above the pump, plus the friction due to its movement; and whose lower line below, and also parallel with the atmospheric line, indicates the pressure above absolute vacuum, due to the height of the pump above the natural water level, minus the pressure required to overcome the friction of the water through suction pipe and valve openings.

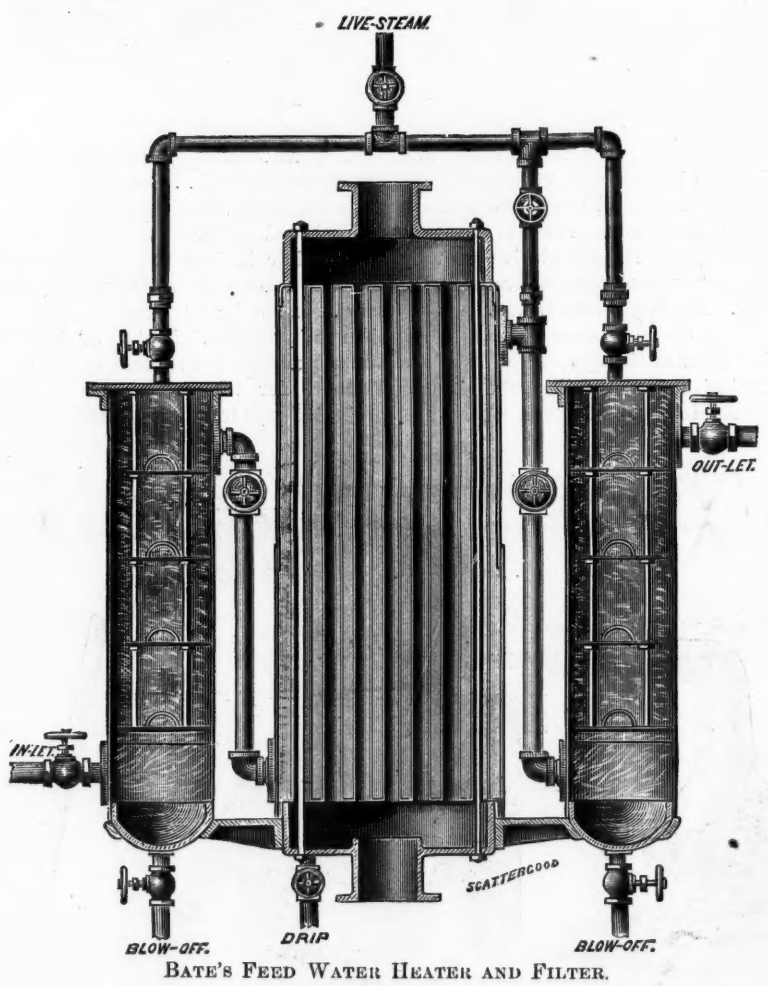
The lower line of the diagram might, perhaps, be better understood by calling it the pressure below the atmosphere required to support a column of water, whose height is equal to the vertical distance of the pump above the natural level of the well, plus the friction through pipe and valve openings; in this case, however, the pressure must be reckoned from the atmospheric line downward.

The correct thing in valves and water ways, is that which admits of the highest piston speed without shock to the water column. When the water has a fair velocity through the suction pipe, the slight check (not enough to produce a ram) which takes place at the complete filling of the pump, produces a reaction in a double-acting pump which promptly opens the suction valves at the end opposite to that just filled, and in such pumps the proportion of the pipe is something well worth looking after.

When the pipe is large enough to furnish a full supply of water to the valves, any further increase in size is undesirable. But such proportion of suction pipe, and other and more important items can only be fixed by repeatedly making the same kind of pump, and closely observing its operation under similar and varying conditions; a view of the case which suggests the improbability of the attainment of best results, from an engineer's early attempts at pumping engines.

### Combined Feed-Water Heater and Filter.

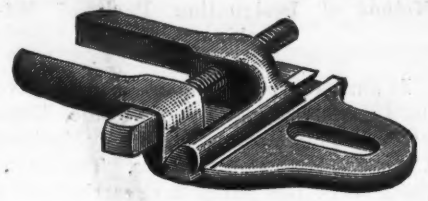
The feed-water heater represented by the accompanying engraving embraces both cold and hot water filters. It will be observed from the engraving, that the filtration is upward, as the water enters the inlet at the bottom of the filter. By this improvement the rapid clogging of the filtering material is prevented. After becoming foul, it can be readily cleaned by admitting live steam above, which forces itself down through the substance, removing all deposit. Each filter, for this purpose, is provided with a live steam inlet and outlet pipes, as shown, in which the cocks should not be opened until after closing the inlet and outlet cocks of both filters used for the feed; then by admitting live steam and opening the blow-off cocks at the bottom, the deposit is quickly blown out.




BATE'S FEED WATER HEATER AND FILTER.

Each part of the filters is accessible by means of hand-hole plates. The feed water is filtered both before entering the heater and after leaving it. By this process all the substances held in solution are removed, thus preventing a deposit of mud upon the tubes in the heater. After leaving the heater the water encounters live steam, which heats the water nearly to the boiling point; then, by passing through another filter, the remaining scale-producing constituents are removed. As some chemical substances are only decomposed at a high temperature, this use of live steam will be appreciated. All parts of the heater are easily accessible for cleaning or repairs. This heater is giving satisfaction where it is used, and is manufactured by Wm. T. Bate & Son, East Conshohocken, Pa.

According to C. J. H. Woodbury, inspector for the New England Factory Mutual Insurance Companies, wood doors, covered with tin, successfully resist intense heat for a long time, and iron doors, of exceptionally good construction, warp under a comparatively slight degree of heat. In many cases, iron doors now in use may be made effective by reinforcing them with wood, backed with tin.



A PROHIBITED DOG.

### A Dog in the Manger.

The U. S. patent laws are intended to protect inventors, and to enable them to reap substantial benefit, while permitting their inventions to be applied to the uses for which they were brought forth. Perhaps, in most cases, these laws accomplish their object. We have before us, however, a case of "dog in the manger," sustained by the patent laws. One of our correspondents writes: "I saw in your issue of Feb. 5th a letter from A. Dolbeer, in which he describes with a cut a lathe dog designed by him. I send enclosed a cut of one which I got up in Aug. 1878. I had never seen or heard of such a thing before. I applied for a patent, got out cuts, a quantity of castings, &c., and was about ready to place it on the market, when I found my claims conflicted with several patents already issued for a dog with *moveable jaws*. That stopped it, there and then. The parties holding the patents have never placed a dog on the market, and will enter into no arrangement to have it done, without a high royalty being paid. There is a real demand for such an article, but there the matter rests. The dogs cannot be made without infringing upon somebody's patent."

The Atlanta & Alabama Railroad, chartered by the last Georgia Legislature, with a capital stock of $3,500,000, has been fully organized at Atlanta by the election of Anthony Murphy, president; J. F. Cummings, vice-president, and B. F. Crane, E. W. Marsh, S. M. Inman, E. C. Howell, R. C. Mitchell, and J. W. English, directors. Two hundred and fifty thousand dollars have been subscribed, and the parties interested say they intend to build the road at once. The road is to extend from Atlanta to Birmingham, Ala., and will give Atlanta cheap coal.

Articles of incorporation of the New Mexico and Rio Grande Railroad company have been filed with the Colorado Secretary of State. The capital stock is $1,000,000. The base of operations will be in Arapahoe county, Colorado, and in Soccoro county, New Mexico. The principal office will be in Denver. The trustees of the company are A. P. W. Skinner, Joseph W. Riggs, B. S. Knowton, Frank A. Robertson, and Theodore F. Brown.

A bill has been introduced in the Legislature of Delaware authorizing the construction of the Delaware Western Railroad, which is in the interest of the Baltimore and Ohio. This road will be completed within six months. It will cross the Brandywine and run parallel with the Philadelphia, Wilmington and Baltimore to Philadelphia, at which point connection will be made with the Bound Brook division of the Central New Jersey, without using the junction road, which is controlled by the Pennsylvania.

It is reported that the State of Florida has closed a contract for draining Lake Okeechobee, under which name is included a small lake and very large swamp that between them occupy great space to no possible purpose. The ground to be thus reclaimed comprises more acres than Connecticut and Massachusetts combined.

The Delaware and Hudson Canal Company will extend their branch railroad from Glens Falls to Lake George, N. Y., by the first of next June.

Columbus, O., capitalists have decided to offer $20,000 in money and seven acres of land as an inducement to a Hagerstown, Md., firm of agricultural implement manufacturers to locate there.

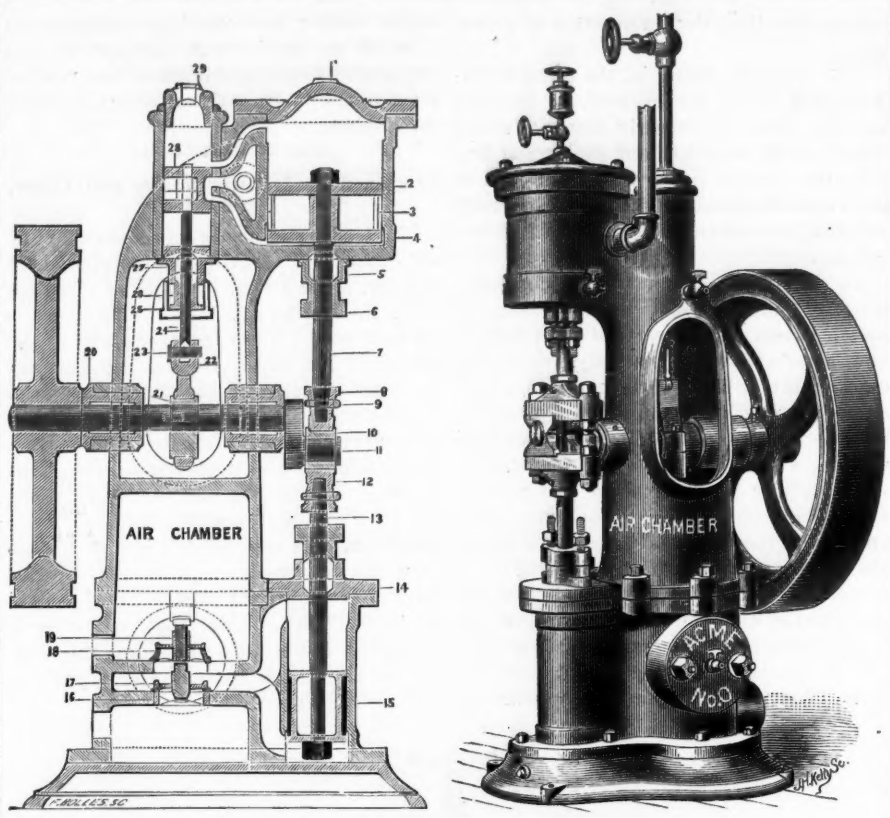
## Method of Designating Parts of Machinery.

In our issue for November, 1878, we gave an illustrated description of the Acme Steam Pump, made by the Valley Machine Company, Easthampton, Mass. The manufacturers of this pump have carried out a system of making the parts interchangeable, and designating each part so plainly by an engraving in their catalogue, that no one need make a mistake in ordering parts to replace those worn out or broken. We present herewith a prospective view of the pump, and a sectional view with each of the parts referred to by number as follows:

1 Cylinder head.
2 Piston follower.
3 " rings.
4 " head.
5 " stuffing box
6 " " gland.
7 " rod.
8 Upper yoke.
9 Yoke pin.
10 Slide box.
11 Crank pin.
12 Lower yoke.
13 Plunger rod.
14 Water cylinder head.
15 Water plunger.
16 Lower valve seat.
17 Lower valve.
18 Upper valve seat.
19 Upper valve.
20 Shaft box.
21 Eccentric.
22 Eccentric strap.
23 Valve stem pin.
24 Valve stem.
25 Valve stem stuffing box nut.
26 Valve stem stuffing box gland.
27 Valve stem stuffing box.
28 Steam valve.
29 Valve chest nut.

In ordering extra parts for repairs, it is only necessary to mention the number on the end of the crank pin and refer to the sectional cut here shown. We commend the plan as worthy to be followed by other manufacturers of machinery.

The Acme pump is double-acting, discharging the full contents of the water cylinder twice in every revolution. It is very simple and reliable, working in almost any exposed situation without the care usually required by steam pumps.




DESIGNATING THE PARTS OF A STEAM PUMP.

The people of Perth Amboy, N. J., have voted to establish a system of public water works.

The engineer's wife threw down her sewing and impatiently hastened into the back yard to settle a noisy dispute among the children. She selected Jack as the offender, and uncoupling her slipper with a quick movement she run master Jack on a siding, and began to mark him "bad order," without regarding signals of distress. By this time Bob, the guilty one, having run on to the secure turntable of the back fence, so that he could run off in either direction, screamed out: "Let up, mother; shut her off, I tell you! You've cut out the wrong car, an' you'll run by the right one if you ain't lively!" The mother coupled up and tried to make a flying switch on the culprit, but he got out on the main line, blocked the section against her, and was running wild for the first siding long before the switch engine could get out of the yard.—*Railway Age.*

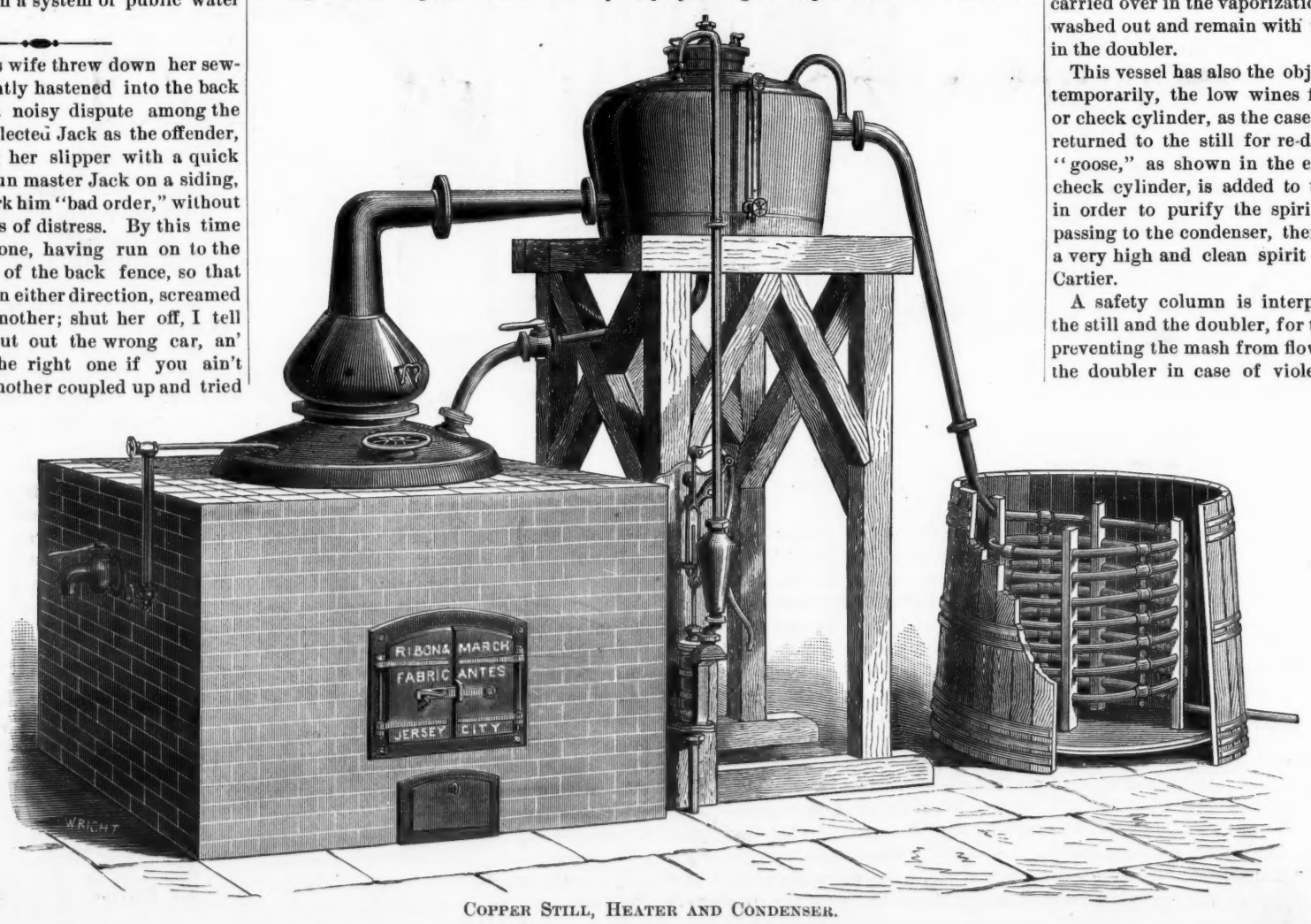
Geo. H. Sanborn, some of whose bookbinding machinery has been illustrated in the AMERICAN MACHINIST, died at Chicago on Jan. 26, in the fifty-first year of his age. His specialties have been widely adopted in the business to which they apply.

Steam generators, such as the shells and flues of steam boilers, are to be made from rings rolled like wheel tires, and without any longitudinal joints. These rings are to be united by joint rings and rivets, or by being slit into one another and riveted in the usual way. An English invention.

The last issue of the *Official Gazette of the U. S. Patent Office* describes the shingle sawing machine patent taken out by a Grand Rapids, Mich., man, in which thirty-two separate claims are allowed, and a patent for an apparatus for packing and weighing tobacco, taken out by a Jersey City man, in which forty-eight claims are allowed. It will take an unusually sharp inventive genius to dodge those patents and bring out similar machines.

The *Boston Commercial Bulletin* says: "The Bates Manufacturing Company of Lewiston will build a large brick quilt mill next spring." This appears to be a new and important industry. Brick quilts may perhaps be cheap, wear longer and be more easily laundried than the usual cotton and wool article in domestic use, or even than the old newspaper-stuffed variety that do service in hotels; but when we come to consider the present frigid state of the weather, and the terrible predictions of the prophet, Vennor, for the immediate future, our prejudice goes to quilts of the old-fashioned kind. Then, again, the new kind of quilts are too much of an innovation upon the time-honored New England custom of holding quilting bees. The young ladies could not stitch the bricks together, and the young men (outside of Maine), for lack of other and more moral amusement, might be tempted to carry home a few of them in their hats.

The citizens of Comanche, Texas, are talking of organizing a stock company for the purpose of starting a woolen mill.




COPPER STILL, HEATER AND CONDENSER.

## New Distilling Apparatus.

The process called distillation means simply the converting of a liquid into vapor, and condensing it to accomplish this effect upon different liquids, many different kinds of apparatus are used. The simplest form of distillation is practised by the chemist using a retort, connected with a receiver. But for distilling alcoholic liquors and high spirits in large quantities, in order to produce a chemically pure liquid, a more complex kind of apparatus is necessary. The rum still is the simplest in form, and consists of the curcubite or pot, the capital or cap, the beak, and the worm or condenser. This form of still requires great care in distilling liquors, in order to get a pure article.

The still, heater and condenser, illustrated on this page, represent a form of still just described, but having an addition of a heater, its functions being, as its name indicates, to heat the charge intended to be distilled in the following batch: This process is adopted in order to save fuel and gain time in the yield of the apparatus, as one or two more batches can be distilled every twelve hours. At the same time it prepares for condensation the alcoholic vapors which pass through its interior coil, so that they are ready to be quickly and thoroughly condensed when they reach the worm. While the simple form of still yields rum of 18° or 20° Cartier, provided the mash has been properly made and is in the required state of fermentation, the latter form of still will yield rum at 22° or 24° Cartier, when properly managed.

The high-spirit distilling apparatus, shown by the engraving on page 5, is used for producing the purest spirit. A "doubler" is attached to this apparatus, and is intended for the purpose of depriving the alcoholic vapors of the impurities of foul flavors carried over in the vaporization. These are washed out and remain with the low wines in the doubler.

This vessel has also the object of storing, temporarily, the low wines from the goose or check cylinder, as the case may be, until returned to the still for re-distillation. A "goose," as shown in the engraving, or a check cylinder, is added to the apparatus, in order to purify the spirits just before passing to the condenser, thereby obtaining a very high and clean spirit of about 30° Cartier.

A safety column is interposed between the still and the doubler, for the purpose of preventing the mash from flowing over into the doubler in case of violent ebullition, caused by want of proper care on the part of the attendant; in such a contingency the overflowing mash will be returned into the still instead of passing through the whole apparatus, as would be the case without this appliance.

The charging screw and discharging stop-cock are furnished with each of the three styles of apparatus described. The cap is constructed so as to be readily taken off when it is desired to clean the curcubite. The safety column as well as the heater is provided with an air valve, which prevents

the formation of a vacuum in any part of the apparatus, and any danger of collapse from external air pressure. When discharging the lees, it is advisable to take off the cap of the charging screw on the shoulder of the still. These stills are furnished with glass gauges, pumps, and all the modern appliances for rapid handling, and working the material for distillation. They are manufactured by Ribon & March, 144 and 146 First Street, Jersey City, N. J.

## LETTERS FROM PRACTICAL MEN.

### Pattern-Shop Machinery.

*Editor American Machinist:*

I am thinking about starting a shop on my own account. But I am a good deal puzzled about how to run it in order to make the most net profit on my invested capital. My mind is quite clear with regard to the machine shop, but the pattern and moulding shops bother me very much. I have spent the last three evenings studying about what kind of "wood-working tools" to put in the pattern shop. I have an idea of my own, but it is so different from the general rule, that I am afraid it is not orthodox. This is the way I intend to do it, and if I am "off my chunk," as the the boys would say, I hope some old, experienced hand at the business will put me right. Now, I intend to employ about five or six pattern makers for the first two or three years, or until I get a good stock of patterns. This number of men will require three lathes—a little one, a bigger one, and a big one. I will have these lathes made different from others in these respects. First: I want each lathe to have five different speeds. Second: I want the small end of the cone set toward the center of the lathe bed. I do this in order to let the workman have a chance to turn his job, both back and forth, without taking it out of the lathe, and chucking it a second time, before finishing. Of course, this can't always be done, but it can be in a great many cases. Third: Besides the ordinary face plates that go with the lathes, I will have two screw chucks and one box chuck for each. Fourth: The outside, or overhanging, end of the cone spindle on the large lathe must be as large in diameter as the inside, or driving end, because it is on the overhanging end of the lathe that all the heaviest of the work is done, such as fly wheels, etc. So you see it should be very strong and rigid. Now, I'll have a good band saw; that is a settled fact. But I want to get a circular saw and a buzz planer, and this is what worries me. I think it would pay well. I can buy the two and have them set up ready for use, for $300. Now, in a shop employing five or six men, these two machines will be worth as much as one good man; so, if I don't get the machines, I will have to employ one more pattern maker. I will have to pay him at least $2.75 per day. Suppose he works three hundred days in the years. I pay him just $825; so at the end of the first year I have a cash balance in favor of the saw and planer of $525, less the cost of power, oil and can, $26.65, leaving a net balance of £498.35, and I have the two machines to boot.

The above calculation looks reasonable to me, but I am afraid there may be something wrong. If not, why do so many shrewd old business men continue to convert pattern makers into circular saws and buzz planers?

I am going to have a grindstone in my pattern shop. The old plan of letting pattern makers scrape along with tools ground on the stone in the machine shop don't pay. The best workmen are always the men who have their tools in the best order, and they are the very men that detest going to grind them on a stone all cut and gouged out with cold chisels and machine tools. I don't believe the best workman that ever shoved a plane, could do justice to a respectable meat ax on the average machine-shop grindstone.

Chordal has this grindstone business down fine. I am going to run my grindstone on Chordal's principle, because I know it is the cheapest in the end.

Besides this model grindstone, I have been telling about, I am going to have another kind. It is a cheap rig and a very useful one. I'll get a small stone, about 8″ in diameter by 1½″ thick, have it set true and solid on an iron spindle. Then I'll take it to the foreman of the pattern shop, and tell him to get it made, so that it can be chucked in one of the wood lathes. This will be a good stone for grinding small tools, spokeshaves, gouges, carving tools, etc., and will pay for itself in a month. I have not quite made up my mind on the kind of benches that I will put up in the pattern shop, nor the kind of lumber I will buy, so I won't say anything about them just now, but will tell about them in the course of a week or two. I will also be thinking about foundry matters.

Yours, respectfully,

Arlington, N. J. J. P. WORKMAN.

### A Durable Piston Packing.

*Editor American Machinist:*

Where there is inordinate wear in a steam cylinder and piston rings, it may, in most cases, I think, be attributed to the foaming or "priming" tendency of the boiler to which the engine is connected; the steam carrying over into the engine more or less sediment of a gritty nature.

This difficulty I have found very common in portable engines, such as are used on the farm. On the subject of "priming," I may have more to say at another time, only wishing now to give my experience in obviating the cutting tendency in cylinder and packing rings.

What I have learned on this subject has been the result of years of experience, and not the deduction of finely-spun theory.

My remedy is to so construct the packing rings that they will yield to anything that may intervene between the ring and the surface of the cylinder; and to accomplish this, I find that a ring three-eights of an inch wide and a quarter of an inch thick is heavy enough for a cylinder seven inches in diameter.

Two such rings are sufficient, and may be sprung into grooves turned a little deeper than the thickness of the ring, and of sufficient distance apart to allow each ring to run slightly over the counterbores at each end of the cylinder.

I have never known this packing to give trouble. It requires but little or no attention, and at the end of a year will be as tight as it was the day on which it was put into the cylinder.

It is easily seen that when any cutting substance comes between the rings and the surface of the cylinder, the elasticity of the rings allows it to escape without material injury to the surface; while a heavy, rigid ring would confine the cutting material doing much damage before it could escape.

If these suggestions will be of any value to your many readers you are welcome to them; and at some future time I may give you some other points in my experience.

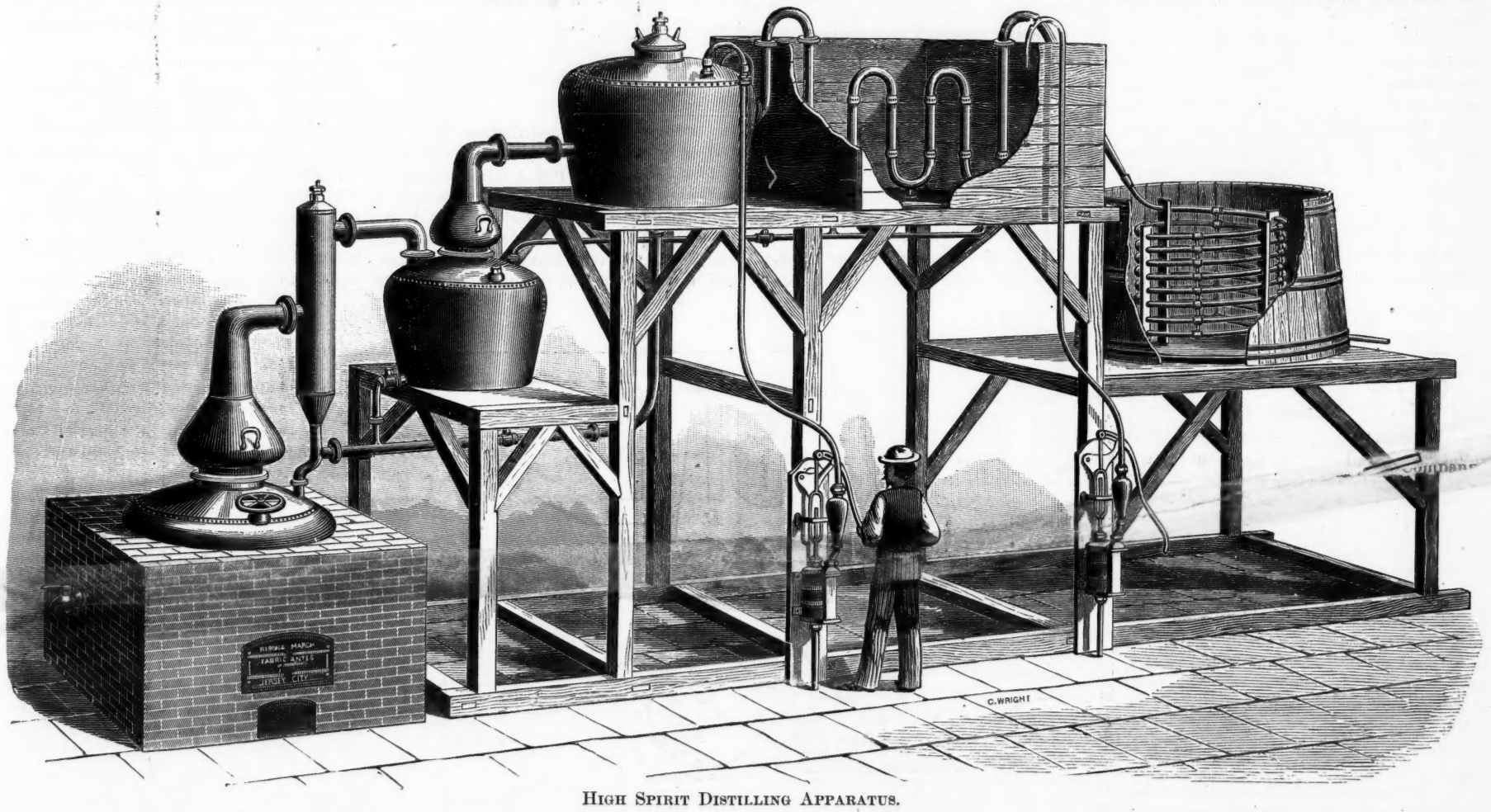
WM. A. L. KIRK.

Chattanooga, Tenn.

### Carelessness with Safety Valves.

*Editor American Machinist:*

I saw in your issue of January 29th an account of the boiler explosion at Newark, N. J., which is an exactly parallel case to the boiler explosion in the Union Mills of Detroit, Mich., which took place about the same time. There were three boilers connected by a large cross drum, on which were two safety valves and the steam gauge. There were valves placed in these connections between the boilers and drum. One of these valves being closed for some unknown reason, the boilers were fired hard, to get the required amount of steam. As this one boiler had no communication with the safety valves or steam gauge, of course it was only a question of a very short time when the explosion must take place. If there had been a safety valve and gauge on each boiler, as there should be where boilers are set in this way, these explosions would not have occurred. Even when safety valves are properly placed on boilers, they are often neglected, as in ordinary cases the valves are set to carry from 10 to 20 lbs. more steam than is necessary to give the required power, and oftentimes do not blow off for weeks at a time. I know it has been so in my experience, and in this way valves often get stuck fast, if they are not looked after every day. In my earlier experience I went to take charge of an engine, and found the weight removed from the safety valves and a piece of 2″ by 4″ studding, with one end placed on the outer end of the lever, and the other end under a rafter, so that the valve could not raise without raising the roof. I afterwards went to take charge of an engine in a flouring mill, and there found a box of brick hung on the safety valve. The boiler was in the basement, and the proprietor said he did not want the steam rising in the rooms above, so this box of brick was put upon the safety valve, instead of having the valve set to relieve the boiler at a reasonable pressure, and providing a pipe to carry off the steam. I have seen other boilers used in just such careless ways. There is an old boiler in use in this town that has been in three different buildings when burned to the ground. It has a small safety valve with the proper weight run out to the end of the lever, and a large line-shaft coupling, also a large globe valve hung on besides. I don't think that 200 lbs. pressure would raise this valve, and a young inexperienced boy has charge of the boiler. But these men will say there is no danger, for they never carry over 40 or 50 lbs. of steam, and that their boilers are in a splendid condition! Night watches and inexperienced firemen, who often have the handling of boilers in these cases, run great risks of




HIGH SPIRIT DISTILLING APPARATUS.

losing their lives, to say nothing of the danger to property. E. D. TOWSLEY.

Sturgis, Mich.

### An Electric Revolution Counter.

*Editor American Machinist:*

In a late issue of the AMERICAN MACHINIST I was very much interested in the reductor to be used in connection with the indicator.

It suggested to me the propriety of sending you a description of an electric revolution counter, which, I am conceited enough to think, will be found of great service to those requiring an accurate and reliable instrument for locomotive service, in this valuable application of the indicator.

Having had occasion to test locomotives for various purposes, and especially at high speeds, I have felt the need of such an instrument, and now have my instrument ready for use on the next trip I may be called upon to make.

My machine consists essentially, first, of an old Morse recording telegraph instrument *A* (see Fig. 1), connections being made as shown, viz.: Wire from the post *B*, to a battery of two Leclanche cells, thence to insulated strap or knee *D*, under the foot-board.

The other wire extends from post *C*, to the engine frame, or any convenient point. On the driving axle is secured a projection, shown at *E*. It can readily be seen that every time the driving wheel makes a revolution the connection is made and broken, which in turn is duly registered by the instrument on the paper, which passes from the reel *F*, and is drawn by a spring over the rollers, and will appear as a dot or dash upon the paper. (See Fig. 3.)

So much for recording the revolutions.

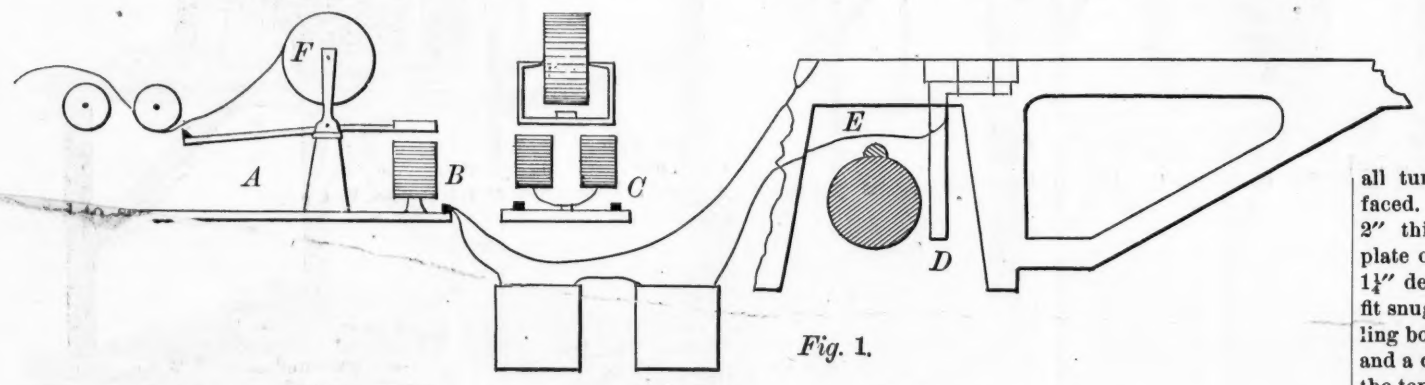



*Fig. 1.*

Now for the important element of time. I have used an ordinary telegraph sounder, arranged so that the lever of the instrument works parallel to that of the recorder, as explained, but which for clearness is here represented in a separate sketch, shown in Fig. 2.

This is connected with a battery of two Leclanche cells; the circuit is made and broken every minute by a pin on the minute wheel of the clock *A*, thus puncturing the paper with minute dots parallel to those representing the revolution, thus making a complete register, as appears in Fig. 3.

So, in taking cards, all that is necessary is to note the time it was taken, and you will have a reliable record to refer to, which I am confident will be appreciated by all who have taken cards from locomotives.

The whole instrument is carried on the front end, with the operator in a small box, and is not the clumsy affair that perhaps this description would lead a person to suppose. D. PRATT WRIGHT,

Draughtsman.

N. Y., L. E. & W. R. R. Co.,
Jersey City, N. J.

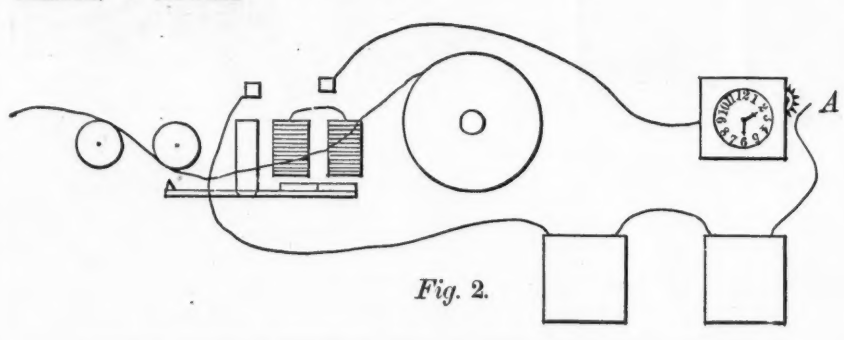



*Fig. 2.*

*Fig. 3.*

### Errors in Computing Centrifugal Force.

*Editor American Machinist:*

Your correspondent, Hugo Bilgram, has, in your issue of January 15th, an article on Centrifugal Force, in which he assumes and demonstrates that, in the text-book formulas for calculating the centrifugal forces of revolving bodies, the "radius" factor should be "the radial distance of the center of gravity of the body from its axis of rotation," or should be the "radius of gravity, and not the radius of gyration" taken in the formulas.

I have given the subject a greatly interested consideration; and, against my preconceived conclusion, I find new methods of demonstration, confirming his, which appear worthy of examination and suggestive to your readers, who are practically and technically interested in the subject.

It may be premised, what is generally understood of centrifugal force, that it is generated in matter by rotary force, applied to swing or revolve the body of matter about its axis of rotation; that it is distinct in its measure and direction of action from the rotary force producing it, and in rigid bodies cannot produce, or increase or diminish the rotary force from which it came; and, that it pervades all the rotating particles which compose the body, acting upon them, wholly and only radially, and tends to force them outward in radial lines from their axis of rotation, with various degrees of intensity of forces, which are "directly as their mass and velocity—square, and inversely as their radial distances from their axis of motion."

On this basis, generally stated, rest the formulas for calculating centrifugal forces, as for example. The formula "Centrifugal force=

$$\frac{\text{Wt. of body} \times \text{square of velocity per second.}}{32.2 \times \text{radius}}$$

and its equivalent

$$\frac{m\,v^2}{r}$$

But in the formulas "radius" is taken, not as the radial distance from the axis of rotation to the center of gravity of the body, but the distance from that axis to the "circle" or center of gyration of the body. That this is an error, and that the "radius" should be the radial distance to the center of gravity appears conclusive, when it is considered that centrifugal force in a rigid body acts only radially to its axis, and in no manner gyratorily; being, in fact, force or stress in radial lines, equally distributed along any and every radial line of particles in the body, from which its mean or medial point of action in any of these lines is found to be at the middle or half-way point of the line of particles length, or at their center of gravity.

By applying the principle that the centrifugal forces of a body are, for its component particles, directly as their mass and velocity square, and inversely as their radial distance, it may be shown, by subdivision of a body's particles, and by taking in detail their individual centrifugal forces, and then combining them together in sum total of the body's entire centrifugal force, that the center of gravity of the body is the true radial distance to be taken,

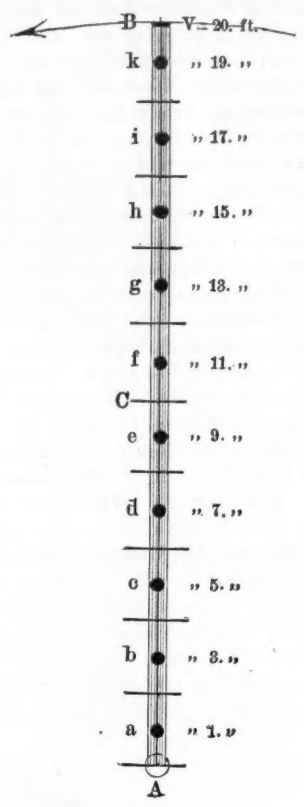



DIAGRAM OF ROD.

in estimating the centrifugal force of bodies by the standard text-book formulas.

Thus:—Suppose a rod *A B* in the accompanying cut, of uniform cross section, is revolved horizontally about one end *A*, at a velocity of 20 feet per second at its outer end B. Let its total length *A B*, be 10 feet, and its weight be 32.2 lbs. uniformly distributed in the rod on its center line. The center of gravity of the body will be at *C*, the middle of the rod, at the radial distance *A. C* = 5 feet, at which point the velocity is 10 ft. per second. Taking for the "radius" of the formula, *A. C* (the center of gravity radius), we have, by the formula, the centrifugal force

$$F = \frac{W\,V^2}{g\quad r}, \text{ or } \frac{M\,V^2}{r} = \frac{1 \times 10^2}{5} = 20 \text{ lbs.}$$

Taking for the "radius" the radius of gyration (or $0.5775 \times A.\,B = 5.775$ feet), the formula gives $\left(F = \frac{M\,V^2}{r}\right) = \frac{1 \times 10^2}{5.775} =$ 17.3 lbs. centrifugal force.

By subdivision of the rod into ten equal sections, and supposing each section to have its particles all concentrated in a point, on the central line of the bar, midway between the section ends, there will be the ten equal masses *a, b, c, d, e, f, g, h, i* and *k*, each weighing $\left(\frac{32.2 \text{ lbs.}}{10}\right) = 3.22$ lbs. and of $\left(\frac{3.22}{32.2}\right) = 0.10$ units of mass. Their velocities are, respectively 1:3:5:7:9:11:13:15:17: and 19 feet per second. By the formula $\left(\frac{m\,v^2}{r}\right)$ and taking for the radii of their centers of gravity, respectively 0.5: 1.5: 2.5: 3.5: 4.5: 5.5: 6.5: 7.5: 8.5, and 9.5 feet, and working out the centrifugal forces of each of the ten masses, gives for them in order, respectively, 0.2: 0.6: 1.0: 1.4: 1.8: 2.2: 2.6: 3.0: 3.4. and 3.8, pounds. Taking the sum of which gives 20 pounds total centrifugal force, of the ten equal masses comprising the whole body of the rod *A B*, which will be seen to be the same result of obtained centrifugal force as in the first given estimate, made by taking the radius at the center of gravity, and therefore establishing its correctness of principle.

What is proved true of the centrifugal force of the particles in one radial line, holds good for particles in all radial lines; and Mr. Bilgram's proposition seems well founded in fact.

MELVILLE CLEMENS.

### Fitting Tapering Shaft Couplings.

*Editor American Machinist:*

I see in your issue of Jan. 22nd, "Easy Way" wants more details about the way of fitting my tapering couplings, and as an account of it will perhaps be instructive to others of your readers, I will give you an account of it. When I first made these couplings I did not know much about universal chucks, and if I had it wouldn't have made much difference, as there was no such thing in the shop. There was, however, a lathe with an arrangement on the slide rest for boring tapers. Allow me to say just here, that a lathe that has no such arrangement, is a very poor tool for general purposes. The coupling castings were first bolted to face-plate and bored to 1¾"; then put on a mandril and all turned to the same size, and the ends faced. A block of wood 8" square and 2" thick was then bolted to the face-plate of a lathe, and the seat bored in it 1¼" deep, in which the coupling would fit snugly but not too tight, and the coupling bolted to the face plate with two bolts and a clamp. The rest was then set to bore the taper from the back side, the lathe being run backwards, and a left-hand boring tool being used and fed by hand until it quit cutting, the largest end of the bore being a trifle less than the size of the shaft. The coupling was then changed end for end and bored in the same way, care being taken not to move the tool. Only one adjustment was necessary to make all the couplings same size in the bore, and the same taper.

The slide rest was then carried to the tail end of the lathe (being careful not to disturb the taper), a piece of shafting put in the lathe, a suitable tool in the rest, and, commencing at 2¾" from the end of the shaft, the tool was fed by hand to the end. This would evidently give the same taper as the bore of the coupling, and if carefully done, the shaft would fit and be true every time.

Of course, with a universal chuck the block of wood, bolts, and clamp, would not be needed, but the operation would be quite the same otherwise.

In doing this sort of work, I use a diamond-point tool, with the point ground off to a little over 1-16" wide, and feed it back over its own cut, using a feed *less* than 1-16" the last time. This gives as fine a surface for close fitting as need be. I use water on wrought iron. This last cut will be objected to by some as a waste of time, but if there is any other way of making as good a finish as this will make, in as little time, I have never found it out.

The main idea in making these tapering fits is to *bore* and *turn* the tapers without moving the tapering arrangement on the slide rest, and using the finished outside of the coupling as a guide in chucking and boring the tapers, to secure concentricity.

As to long-line shafts in one piece, they are certainly not altogether free from objections, the main one of which is that nothing but split pulleys can be used on them; but I do not believe that it is practicable to make a line shaft in short lengths that will run as true and as smooth as if in one piece. P. J.

Hockley, Texas.

### An Engineering Explanation.

*Editor American Machinist:*

In your article on the Compound Boiler, issue of February 5, the statement is made that the Buckeye engine, which the boilers supplied, showed on a test a consumption of 29.7 lbs. of steam per indicated horse power per hour. As the conditions under which this result was obtained are not given in the article, allow me to call attention to the matter.

The engine worked under a boiler pressure of 84 lbs. and a back pressure, due to using exhaust steam for heating, of 4.5 lbs. above the atmosphere. The actual cut off was 25.2%; the absolute terminal pressure 19.2 lbs.; the mean effective pressure 27.8 lbs.; and the speed 60 revolutions per minute.

Had the back pressure been 0.5 lbs. instead of 4.5, as commonly obtained in well-arranged exhaust pipes, and the conditions of cut-off and boiler pressure been the same, the mean effective pressure would have been $\frac{4.5 - 0.5}{27.8} = 14.4\%$ greater, and the total consumption of steam probably the same.

Under these conditions the consumption of steam would have been reduced to $\frac{29.7}{1.144} = 26$ lbs. per indicated horse power per hour; and the consumption of coal, on the basis of the evaporation of the boilers given, would have been $\frac{26}{11.08} = 2.34$ lbs. per indicated horse power per hour.

At the usual high speed at which these engines work, the consumption would doubtless have been still less.

GEO. H. BARRUS.

Boston, Mass.

### Counterbalancing Engines.

*Editor American Machinist:*

I would like to ask some of your mechanical readers to solve the question of the balancing of a crank pin, and half the weight of the connecting rod. Some of our best Canadian Engineers assert that only the pin requires to be balanced in quick-running horizontal engines; others assert that the balance ought to be equal to the crank pin and half the weight of the rod. Each of the contestants give mathematical reasons for their assertions. I should feel obliged if some of your clever mechanical correspondents would give their views on the matter. Perhaps Mr. Charles T. Porter would write a word or two on the subject.

J. H. KILLEY.

Hamilton, Ont.

### Worm Gearing.

*Editor American Machinist:*

In a recent number of your paper, which has attracted my attention, there appears an answer to a correspondent, who seems to have encountered the difficulty of finding the place of the pitch line on a worm and its wheel, which answer sets forth the correctness of laying out the teeth on the plane of the axis of the worm, as is usually done for a rack and pinion, and refers the querist to a previous number of the AMERICAN MACHINIST, of February 7, 1880, for a reply in particular.

Recurring to the paper mentioned, it appears that the editorial statement is sustained therein, and that worms and worm wheels thus laid out are not satisfactory mechanisms, presenting, as is asserted, great loss of power from friction, and wearing out rapidly—giving the inference that, except where used as a means of adjustment, rather than as a method of transmission of motion, the employment of this gearing is inadmissable.

Notwithstanding this view of the case, it is well known to all machinists that the use of the worm, as a transmitter of force, is not only frequently practiced, but the practice is largely increasing, until worm hoists, both large and small, and worm-driven large lathes and boring bars, are becoming frequent in the workshops. It is also known that some of them do not wear rapidly, and do not fail to transmit a large part of the power given to the worm shaft. That the friction is so surprisingly small, that the application of considerable weight, or a load on the wheel, will overhaul the worm, so that worm hoists, generally, require a friction clamp on their driving pulley to prevent their running away when the belts are shifted on to the loose pulleys.

It is about fifteen years since, when my attention was brought to the action of some worm gearing, which had been *made* to run smooth, that an investigation into the place for the pitch line, led me to a different conclusion than that given in the text books in general — Prof. Willis and Prof. Rankine being the accepted standards*—and the following method of arriving at the pitch was then elucidated for the benefit of the draughtsmen in my charge. And this method has had general practice in perhaps twenty or thirty examples since then, with uniform success in construction of *running* worm gear.

Accept the theads on the worm to be 0.65 of the pitch in height radially (or length), of which 0.60 is to be the face of contact with the teeth of the wheel. Let the teeth on the wheel follow the circle of the worm through an arc $\alpha$ (about 60° should be the largest value for $\alpha$).

Let $R$ = outside radius of worm; $R_p$ = radius of pitch of worm; $P$ = pitch of teeth; $F$ = face of wheel at root of teeth:

$$\therefore R_p = \frac{R + (R - 0.6\,P)\cos.\frac{\alpha}{2}}{2};$$

$$F = 2\,(R + 0.05\,P)\sin.\frac{\alpha}{2}.$$

The teeth can be either epicycloidal or like those shown in the paper referred to—of course, the former are preferable. The threads on the worm (rack teeth) are turned into the same radial section; those on the wheel (wheel teeth) are to be laid off in plane sections, parallel to the plane of the axis of the worm, advancing or retrograding the point of the pitch to suit the inclination of the pitch on the worm; the *foci* of wheel pitches being as usual for wheel, a cylinder.

To simplify the problem in practice, it has been usual to make the outside radius of the worm $= R = 2\,P$, and the angle $\alpha = 60°$, and also to use not less than 30 teeth in the wheel, but where less variation of speed than 30 to 1 is demanded to employ double or treble-threaded worms (30 to 2; 30 to 3). These proportions give the place of the pitch line on the worm $= R_p = 0.803\,R$, and give the length of the bearing face of the wheel teeth, reckoning from the point of the teeth to the outside of the worm $= 0.788\,P$. These dimensions are, however, in no regard essential, only they give convenient proportions. It is best to true up the worms, although, when many are to be made, they can be cast and screwed out of the mould. Worm wheels, however, are very troublesome things to cut, except when the number of teeth is great, when a circular cutter, properly shaped and set to a proper angle, will answer to form a wheel to wear to a good bearing eventually. Worm wheels, to be cut accurately, must have a worm cutter, and the wheels must be rotated in front of the cutter—not derive their rotation from the same cutter. The writer of this knows a 36-tooth worm wheel, cut by one of the best tool makers in America, which has 18½ teeth on one side of a line through its center, and 17½ teeth on the other side, the worm cutter having routed its own pitch line and given shape to the teeth to correspond.

It is indispensable that there be no spring in the worm shaft, or side spring or end motion in the wheel. The least yield here is productive of as fatal results to this kind of gear, as similar yielding is to bevel or miter wheels. With all these precautions taken, the self-lubrication of the teeth of worm gears becomes the most perfect application of a lubricant, (to preserve a film of oil on the wearing surface), known in mechanism. When wheels are arranged, as above described, the small value of the coefficient of friction of the worm on the wheels, which has been found in most cases, is surprising. Taking the weight needed to overhaul the worm gearing, less than one per cent. is the usual result.

ROB'T BRIGGS, C. E.

Philadelphia, 220 South 4th St.

* Weisbach, however, shows, in his illustration of a worm gear, the pitch line close to the body of the worm,

### Progressiveness in Iron Foundries.

*Editor American Machinist:*

In your issue dated January 29, Mr. R., of Troy, gives his ideas or opinions of matters pertaining to foundries and their management. As a portion of his criticisms were answered by "Old Chip," probably before this he will have learned a few of the difficulties that foundrymen encounter.

I will try to answer but a portion of his very able communication. He thinks the climax of my answer to "A Foreman" was in not having draw irons to fit tapped holes. I did not intend to offer that as a reason for poor castings. I believe I mentioned that merely to show our mutual friend, the foreman, that a little attention to details outside of the foundry would facilitate business inside of it. Mr. R. says he fitted up a pattern in the highest style of art, with elaborate draw irons, which were discarded for a ten-penny nail. That is just the trouble I complain of. My friend neglected to consult the foundryman. If he had done so, he very likely would have been told just what he wanted, and have saved the expense of making those exquisite draw irons. All metal patterns, or wooden ones, do not require draw irons. There are plenty of patterns of such shape and thickness that draw irons with a thread are useless, and a ten-penny nail or wooden plug will get that pattern out of the sand while you are entering the thread of your exquisite draw iron. The foundryman will tell what he needs to draw a pattern with better than anyone else.

Mr. R. wants something devised whereby a 7x9 foundry will not require a ten-acre lot to stow their flasks. Why, that is already being done. If he will go to Wm. Sellers & Co., of Philadelphia, he will see the most complete method of regulating the size of flanks, by making them in sectional parts, whereby they can be lengthened, widened, deepened or made shallow, with but few pieces. All their flasks are kept under a shed 30x50, or thereabouts.

There is no trouble about those matters, if you have sufficient capital to make the plant.

I would inform my friend that I have visited a Bessemer steel works, and I am thoroughly convinced that only to a limited extent could castings be poured in that or any systematic manner. There are at present several chilled car wheel shops who pour their wheels by over-head cranes. Pipe works, by a steam crane, handle iron with very little strain to the back; but I would inform my friend that there is as much art in pouring the metal in too green sand moulds as in any other operation. He who makes the mould knows best how to pour metal in it. Castings are of such irregular shapes and thickness, that more than one inlet is requisite to run them. I have made work that required eight men to pour it, and then it was a question whether it would run. The idea of my friend, that moulders do not contribute their quota of original or advanced ideas in common with other craftsmen, is erroneous. In the multitude of apprentices who serve their term at the various trades, there is not, I am sorry to say, any means of selecting those who may be best fitted by nature to some particular calling. It is a scramble to get a chance, and it would seem that a spoonful of brains would be as liable, and just as probable to get into a foundry as in any other of the arts. The fact is, the moulder is continually inventing with every new job that comes to his hands, for every new and complicated pattern has to have more or less variation in its treatment in the foundry.

A FOUNDRYMAN.

Toledo, O.

## Newly-Incorporated Companies.

MASSACHUSETTS.

The Laskey Manufacturing Company, Boston. Isaac F. Dobson, president; Chas. E. Fuller, treasurer. Capital, $600,000, in shares of $100 each. For the manufacture and sale of self-leveling and self-adjusting tables, bins, stalls, or other like articles, especially those patented by J. H. Laskey, and all business connected therewith or incident thereto. Jan. 19.

Clark's Cove Guano Company, New Bedford. Henry A. Barling, president; Thos. M. Hart, treasurer. Capital, $100,000, in shares of $100 each. For the manufacture and sale of fertilizers. Jan. 25.

The Boston Marquetry Flooring Co., Boston; J. Otis Wetherbee, president; Henry Waterman, treasurer. Capital $5,000, in shares of $100 each. For the making, selling and laying marquetry flooring, the manufacture and sale of hard wood house finish, inlaid dado work, and house, cabinet and car mouldings.

PENNSYLVANIA.

Colebrook Valley Railroad Company. Principal office, Lebanon. Robert H. Coleman, A. Wilhelm, and others, incorporators. Capital $400,000, in shares of $100 each. For the construction of a railroad, 18 miles in length, from the Cornwall terminus of the Cornwall Railroad, in Lebanon county, to Conanago Junction, on the Pennsylvania R. R., near Elizabethtown, in Lancaster county. January 26th.

Warren Railway Company. Principal office, Bradford. John D. Mandeville, George A. Berry, and others, incorporators. Capital, $72,000, in shares of $100 each. For the construction of a railroad, 12 miles in length, from the village of Kinzua, in Warren county, to the borough of Warren, in said county. Jauuary 28th

The Westinghouse Machine Company. Pittsburgh. George Westinghouse, Jr., Ralph Bagaly, and others, incorporators. Capital. $200,000, in shares of $50 each. For the manufacture of machinery of all kinds, whether patented or not, the building of steam launches and boats, and their equipment, and dealing generally in machinery, patented specialties, and manufactures by scientific process. January 31st.

CONNECTICUT.

The Lees Manufacturing Company, Westport. James E. Lees, Robert T. Lees and John J. Alvord, incorporators. Capital, $25,000; shares, $50 each. For manufacturing and dealing in cotton fabrics.

The Glastonbury Knitting Co.; A. L. Clark, John R. Faure, and others, incorporators. Capital $30,000; shares $100 each. For manufacturing and dealing in knitted and woven goods of every description.

The New Haven Japan and Varnish Co.; Henry C. Shelton, John A. Fleury, and Carlos Smith, incorporators. Capital $6,000; shares $25. For manufacturing and selling japans, varnishes, lacquers and chemicals.

The Boston *Herald* says: "At the time of the Ashtabula horror, when so many persons were burned to death by the wrecked cars catching fire from the stoves, Mr. Webster Wells, then professor of mathematics at the Massachusetts Institute of Technology, began to consider the problem of heating the cars without fire. He has now solved it. His invention consists of a strong iron cylinder, at one end of which, inside, is a fixed plate of hardened iron, against which, firmly attached to a revolving shaft, another plate presses, either closely or lightly, as required. The cylinder is filled with water, and this, heated by the friction of the two plates, circulates through pipes, warming the room through which they run, just as steam pipes do. The water is kept in constant circulation in these pipes, returning to the cylinder to be heated over again. The water in the cylinder, which is brought to a high degree of heat in a remarkably short time, keeps the plates lubricated, preventing their wearing away at a rapid rate. The machine can be utilized in any place where power is used,"

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

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NEW YORK, FEBRUARY 19, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

## Too Much Variety.

A great many shops in this country are working without any definite or fixed plan of action. Doing at some seasons of the year a good deal of job work, at other seasons very little, a spasmodic, intermittent attempt at whittling out steam engines, or water wheels, or some machine-tool specialty chinks in to fill up unoccupied time, and of such items the balance sheet of the year's work is made up. A well-considered plan of action may do for such shops what the compass does for the mariner or the tail does for the kite, and either service is worth all it costs.

Are you starting a new shop, intending to put a competing machinery specialty into the market? Very well. In order to get a foothold for your product, you must make it well; and you must make it cheaply, and you must get it before the purchasing public, after you have thought far enough into your problem to find out who *your* particular purchasing public are. Now, to do all this, takes time and money, and pluck and patience, and numerous other equally valuable qualities. But life is short, and your common sense tells you that time presses. Your capital is small, or at least limited, and you cannot afford to use up too much of it in costly waiting. Your pluck and patience will all be needed by and by, when you are squarely on your legs with your chosen specialty, and it is awkward to feel these valuable ingredients oozing out at your finger's ends. While you are incubating your plant and your patterns and your product, and getting ready for a tussle with the market, setting aside a good-sized corner of your premises for a jobbing shop may be, for you, a good investment. It will tend to keep you in hope, and if rightly handled, will make a good stepping stone from which you may reach the desire of your heart.

But having got fairly started in your specialty, how is it then with the jobbing-shop attachment? It is well a-going, and you are doing a good bit of work, and some of this pays a big per-cent. True, it is retail, and you always had a hankering after the wholesale side of life and business, but you can't exactly bring yourself to drive good job-shop customers away, and so you go on, year after year, doing a little of both, wearing out your tools, and frittering away your chances of a wider market and a better business. The same shrewdness that induced you to admit jobbing into your shop in the first place, somehow failed to show you the precise point, when a growing pressure of discouragement in that direction, and a judicious forcing of your chosen specialty would have been in order. This rule would have saved you. Job at first to keep the pot boiling, then begin to drop jobbing in all cases except when it *pays*. In other words, don't do jobs to oblige your friends merely, but for the profit there is in them, and put in your big strokes on your own business.

Your neighbors across the way, too, have had an instructive experience. There are two men in the concern, and they started out a good many years ago to "build" steam engines, both small and large, though to *carpenter* steam engines might perhaps have been a better word. They never dreamed of any other method than chopping their engines out, one at a time. Two at a birth, exactly alike, would have seemed to them one too many. Now, what got them into this constipated frame of mind? Simply this: Instead of marking out a consistent course of action as to their product, and sticking to it, they have simply drifted. One customer wanted his engine such a size or style, and others wanted different sizes or styles, and, in turn, everybody was accommodated. In a few years' time your neighbors across the way find three-fourths of their capital locked up in what they are pleased to call "patterns" of steam engines, varied enough, in some respects, to supply the needs of a continent. Pretty soon, too, they find that while the capable, level-head engineer around the corner is evolving plans for yoking capital and labor together on a large scale for the systematic *manufacture* of small steam engines by the wholesale duplication of parts, the best hold for the future of *their* business consists in largely attracting the jobbing work, which you began to discourage years ago.

But there is one important feature about the plans of the man who sets out to really *manufacture* small steam engines, or any other large article, and it is the ear-mark by which you may discover that he is really capable and level-headed. You will not find him figuring on making many sizes. The customer who wants a different size or style, to suit some special purpose or whim, will have to go elsewhere, either to your neighbor's carpentering establishment across the way, or to some modern shop, whose specialty includes that particular size or style. In course of time, you will find that this engineer will have arranged matters to scoop in, for a thousand miles around, a huge pile of orders for his pet sizes.

Look at the experience of the big mower and reaper shop at the foot of the next street. How many sizes do *they* make? They make a junior mower, a senior mower, and a reaper, and they employ a thousand men. But for the necessity of wheedling the rural mind, their wholesale selling agent could catalogue the products of the establishment on his thumb nail!

## Crossing Bridges too Soon.

Next to the industry of inventing things that never will be worth anything, comes that of inventing things that will not be wanted for some hundreds of years to come. If it were not pathetic, it would often be amusing to note the unlimited study and conjecture which certain too-philosophic minds continue to waste upon the appliances that will have to be discovered and put into use when all the timber of the country has been cut down, or all the coal has been mined, or all the petroleum deposits have been exhausted, to say nothing of such bewildering problems as deciding what will become of us when the sun's heat is no longer a potent element, or the moon is no longer green cheese. It is safe to say that the time, money and thought wasted upon unproductive studies of this character might, if rightly handled, go far toward averting the fearful consequences that would be likely to ensue, should any of these dreaded calamities actually occur some ages hence.

The trouble is, these students of future contingencies, in confining their researches to the material side of the questions involved, make the mistake of leaving the activities of the human mind wholly out of the account. Chemistry and science and mechanics will have something to say about all this, before the hour of our direst need arrives.

It would not be any detriment to the mechanical interests of the country to have a few—at least two or three—engineers in Congress, who know something more about mechanism than the fitting of change gears and belts upon the political machine. There is some talk about running a railroad through the desert of Sahara, also of constructing a level ice road from Greenland to the North Pole, so as to mount ships upon runners and slide them over the course. It is thought that as soon as the advantages of these two enterprises to American excursionists and shippers of freight are well advertised, Congress may be induced to consider the propriety of either granting a liberal subsidy to each, or of guaranteeing six-per-cent. interest on a trifle of, say $50,000,000, of first mortgage bonds. The fact is Congress has never shown a spark of liberality in aiding great railway schemes outside of the United States—not even in Mexico—and its attention has been called to this point, very earnestly, by some patriotic citizens who are desirious of seeing a reform in that direction.

Our correspondent, "Chordal," has been so overcrowded with engineering work for a few weeks past, that he has been unable to finish any one of the many letters which he has found time to begin for our columns. This week he shows his hand on the foundry, pattern and designing question, in a way that cannot fail to prove interesting and profitable to many readers.

In recent issues we have published some sixty letters, from representative machinery establishments, detailing the progress made during the year just closed, and the prospects for the year 1881. The AMERICAN MACHINIST has shared in the general prosperity. The six issues published since the present volume began have seen our edition enlarged nearly 1,000 copies, in order to satisfy the growing demands of new readers.

## Literary Notes.

HOUSE DRAINAGE AND WATER SERVICE IN CITIES, VILLAGES, AND RURAL NEIGHBORHOOD, ETC. By Jas. C. Bayles. 8vo. cloth. New edition—price $3.00. Published by David Williams, 83 Reade St., N. Y.

The book bearing the above title has already run through two editions, and the present edition, the third, has been issued, proving that the general public are becoming alive to the importance of a close study of the mechanics of hygiene, and kindred subjects relating to the ventilation and water supply of private as well as of public buildings.

The author very clearly explains some of the apparent mysteries connected with sewer gas; also the incorrect application of the term in many instances, the gas being generated from the deposit of filth in the pipes, where it decomposes, and does not come from the sewer at all.

This question, together with many others bearing upon the subject, is very ably treated by the author under the following heads: Hygiene in its Practical Relations to Health, Sewer Gas, Waste and Soil Pipes, Explaining Proper Method of Traps, Seals, and the Ventilation for the Same; Closets, Service Pipes and Water Service in City Houses, Tanks and Cisterns, The Chemistry of Plumbing, Elementary Hydraulics Applied to Plumbing Work, Sanitary Construction and Drainage of Country Houses; also Water Supply in Country Districts. Valuable suggestions are given concerning the sanitary care of premises. The position of the author, as editor of the *Iron Age* and the *Metal Worker*, has enabled him to treat the plumber and his work in a fair and reasonable manner.

The book is a valuable treatise on the subjects referred to; and should be read, and its advice followed, by those having charge of buildings everywhere.

The *American Engineer*, of Chicago, has completed its first volume (the first year) and signalizes the event by an enlargement. It is neatly printed on extra book paper, and publishes many valuable papers read before the Western Engineers' Society, as well as other practical articles.

The *Textile Record of America*, published by Nagle & Ryckman, and edited by Lorin Blodgett, Philadelphia, is one of the most thorough and substantial of the new mechanical journals that have made their appearance within a year past. It is original and aggressive, and has apparently carved out success. Issued monthly at $3 a year. Apropos of the difficulties encountered upon starting a new journal it expresses itself editorially in this blunt style:

The man who believes that he can leap to success in the establishment of a great public journal has certainly more zeal than judgment. He could not choose an avocation in which he would be confronted by more obstacles, perplexities, discouragements. He could not find a station in which there is so little sympathy for unrequited labor. It is only after a long siege of "toil by day and lamp by night;" of conflict with a host of various ideas; of disfavor by those whose interests he most ardently es-

pouses; of disheartening pecuniary losses; of oppositions, contradictions, jealousies unnumbered, that he may hope to enjoy the fruits of his energy. It would be easier to storm Gibraltar with a penny pistol than convince the minds of some men that a newspaper or magazine is worthy of their attention, no matter how earnestly, devotedly, or successfully it may avow their cause.

---

*The Blacksmith and Wheelwright*, of New York, is one of the successful new mechanical journals. It has got into its second year with every indication of permanently staying in the field. It sticks to its specialty, and gives in every number a fund of practical information. Monthly, $1 a year.

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The *Jewellers' Journal* of Chicago, takes a high rank among new technical journals. The number for January comes out enlarged and improved. It is both artistic and practical, and is deserving of a large patronage from the trade it represents. $1.50 a year.

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*Science*, "a weekly record of scientific progress," has reached its thirty-second number, and occupies a distinctive field of its own. It is, as its name implies, scientific, but not commercial. Its contributors are leading scientific authors. Subscription $4 a year. John Michels, editor, 229 Broadway, New York.

---

Among the new ventures in mechanical journalism is *The Mechanical Engineer*, by Egbert P. Watson & Son, 5 Beekman Street, New York. It is an eight-page weekly issue, and is printed in large clear type, with three columns to the page. Mr. E. P. Watson is the author of "Modern Practice of American Machinists and Engineers," and "A Manual of the Hand Lathe," which have had a large sale. Our readers will remember some practical articles contributed by him to our columns. The mechanics of our land have become accustomed to read practical periodical literature more than they formerly did, and we wish the new venture success. $2.00 a year.

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The *Scientific News*, formerly published semi-monthly by S. H. Wales & Son, has been sold, together with its patent right business, to Munn & Co. of the *Scientific American*, and is changed to a monthly issue. It comes out in magazine form, enlarged, finely illustrated, and with quite a variety of reading matter. The subscription price has been changed to $1.50 a year.

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The substantial advancement in all departments of mechanics, within the last four or five years, has been fully kept up with—we might say led—by American journals representing the different mechanical interests. It must be evident to any intelligent reader of technical literature that the best class of journals representing the iron, railroad, textile, milling, leather, lumber, carriage and other mechanical industries, are decidedly better than they were four or five years ago. The readers seem to expect more, and the publishers are active in anticipating and gratifying those expectations. Thus has the standard of excellence gradually but surely risen. No such noticeable advances have been made by the daily newspapers, as a class, probably because their position and influence have so long been conceded by the public, that hardly anything higher remains to be reached. Although first-class technical journals of to-day involve considerable more labor and expense in their production than they did a few years ago, their success is proportionately greater, as the public—or at least the practical portion of it—has grown more discriminating and appreciative since the *necessity* of such publications have become more generally recognized. Our exchange table is favored with about all the mechanical journals in this country and quite a number from abroad, not one of which is thrust aside without scanning its contents. Their particular improvements are, therefore, readily noticed by us.

In our issue of January 22d, 1881, we took occasion to make extracts from the notices given by leading daily papers to "Extracts from Chordal's Letters," which we have recently published in book form, with original illustrations. This week, we take pleasure in noting the favorable impression made by the book on a number of other daily newspapers. Within our observation, no new book has received more favorable recognition by the leading influential newspapers of all classes. We have space for but a few quotations from reviews.

The letters are written in a manly, terse and epigrammatic style, that commanded attention and approbation on their first appearance in the columns of the periodical, and the choice extracts, included in the volume now issued, will command a still wider circle of readers. These letters were written in the interest of practical mechanics and manufacturers, but they are full of truths and theoretical discussions that will interest intelligent and thoughtful readers.—*Providence Journal.*

The style is peculiar, sometimes humorous, at others ironical; but admirably calculated to arrest and hold the attention of many mechanics who would never read the contents, if placed in any other form. The treatment is that of an enthusiastic mechanic, who has the higher education of his craft in view, and who endeavors to instil into their minds a just pride in their profession. Every machinist, foreman, superintendent and manufacturer should read this book.—*Springfield Republican.*

It will be seen from the subjects treated that the book is a practical work, designed for mechanics; and it is further full of information of a varied character, which workers in any of the trades will find entertaining.—*Brooklyn Eagle.*

There is stuff in these writings to make men better workmen, and to understand well their relations to their employers and the community.—*Brooklyn Times.*

This volume is made up of extracts from a series of letters to the AMERICAN MACHINIST that attracted a good deal of attention, and is particularly addressed to mechanics, though all classes will be interested in a perusal. It deals with many of the questions agitating the public mind with regard to the great mass of workmen in the country, and does it in an off-hand, familiar way that will reach many that a more pretentious style would not.—*Toledo Blade.*

The merit of these letters, we think, fully warrants their reappearance in book form. They touch upon the thousand-and-one things which vitally interest the mechanic with an invariably common-sense intuition of what to say, and how to say it. The style is good, being clear and sprightly; the interest is never allowed to flag. The work deserved to be published, because it deserves to be read.—*Troy Times.*

A perusal of the book shows that the numerous encomiums passed upon it by the Eastern press are well merited. Although the topics treated are purely mechanical, yet they are full of interest to those outside of the shops. We doubt if a more interesting, practical or tasteful volume for the craft has been issued in late years. We look for a large sale for the volume.—*Hamilton (Ohio) Daily News.*

## QUESTIONS & ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.*

(1) Wm. C. H., Indianapolis, Ind., writes: I have a spring of water, supplying at its issue a one square inch stream, making a 14 foot fall. I desire to place under it a 12-foot overshot wheel, and to force water from the tail-race by the wheel and a pump up through pipes, 70 feet high. What portion of the water can I pump up? *A.*—We should say that you could raise very little water 70 ft. high, with the stream and apparatus named. The frictional resistances of the machinery and pipes would consume all, or nearly all, the power of such a slight waterfall. But you could, probably, raise about one-tenth of the waterfall the 70 feet with a good, suitably-adapted hydraulic ram.

(2) E. L., New York City, writes: With a cylinder or drum, 6 feet in diameter and 5 feet long, revolving on a vertical axis, and containing 1,500 to 2,000 pounds sand or gravel, how many revolutions should it make to prevent any of the sand from falling back on to the shaft? Also what power is required to drive the drum at the speed required? *A.*—The drum must revolve at its periphery at such a speed, that the sand carried around with it shall have sufficient centrifugal force to raise its outer edge about four feet high in the drum, and maintain it, sloping inward down to the base of the cylinder, clear of the shaft. Taking the sand as weighing about one-half more than water, the centrifugal force that would support the sand 4 feet high, would be the same as the force that would support a column of water a half higher, or $(4+2)=6$ feet high. To lift a column of water 6 feet high, by centrifugal force at the end of a hollow arm of 3 feet radius, would require, theoretically, the end of the arm to revolve horizontally at a velocity equal to the velocity of fall by gravity from a 6 foot height of head. This velocity is

$$(V=\sqrt{2gh}=\sqrt{2\times32.2\times6})=19.8$$

19.8 feet per second, and is the theoretical velocity to be given the drum. But, in practice, under the conditions given, this velocity should be made fully 50 per cent. greater, or, say, 30 feet per second. With this speed the drum will make

$$\left(\frac{60.\times30.}{6.\times3.1416}\right)=95$$

95 revolutions per minute. The power required to drive the drum at this speed, depends upon how fast the sand is let in and out, or the amount of sand worked in a given time. Putting $W$ for the weight of sand worked, and $V$ (=30 feet per second) for velocity of the drum, and $P$, the horse power used, the formula for the horse power would be

$$P=\frac{C\ W\ V^2}{2\ g\times33000},$$

in which $C$, the coefficient for including frictional resistances, may be taken as 1.25. Thus, for example: If 5,000 pounds sand be worked per hour, the power required would be

$$P=\frac{1.25\times5000\times30^2}{2.\times32.2\times33000}=2.65$$

2.65 horse power.

(3) H. S., Delaware, Ohio, writes: Two vessels, filled with a fluid, one of 5 cubic feet contents, under 60 pounds pressure per square inch, and the other of 2 cubic feet contents, under 25 pounds pressure, having communication opened between them, what will be the resulting pressure of the fluid in the two vessels? Please explain how to calculate it. *A.*—If the vessels are filled with water, or any other non-elastic fluid, take for each vessel the product of its contents and pressure, and add the product together. Divide this sum by the sum of the two vessels' contents. Thus for example: The products of the contents and pressure of the two vessels are

$$\left(\begin{matrix}C.\ F\\5\times60\text{ lbs.}\end{matrix}\right)=300$$

300 ft. lbs., and

$$\left(\begin{matrix}C.\ F\\2.0\times25\text{ lbs.}\end{matrix}\right)=50$$

50 ft. lbs., and their sum is $(300+50)=350$ ft. lbs., which, divided by the sum of the vessels' contents $(5+2)=7$ cub. ft., is $\left(\frac{350}{7}\right)=50$ lbs., which is the resulting pressure. If the vessels are filled with steam, air, gas, or any elastic fluid, or fluids, absolute pressures, densities, and temperatures enter into the calculations.

## BUSINESS SPECIALS.

*50 cts. a line for each insertion under this head.*

Foundry and Machine Shops for sale at Sioux City, Iowa. Large brick shops, with good tools—large trade in growing country—good reason given for selling. Address J. P. Dennis & Co., Sioux City, Iowa.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Bicycle repairs, spider wheels, frames, bells, stands &c. T. B. Jeffery, 253 Canal Street, Chicago.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

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Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

See Christiana Machine Co.'s adver., on page 14.

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathes, and Watch Machinery.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

"Extracts from Chordal's Letters" in book form, now ready. Cloth. 320 pages. $1.50 by mail, postpaid. American Machinist Publishing Co., 96 Fulton Street, New York.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

The Fond du Lac Machine and Iron Works desire to add the manufacture of automatic cut-off steam engines to their busines, and wish to communicate with parties owning the right of a superior cut-off with a view of manufacturing under a royalty. Address, Charles J. L. Meyer, Fond du Lac, Wis.

## MANUFACTURES.

A traveling correspondent writes us as follows from the West:

At present, everything is energy and activity among the lumbermen of the Northwest. The winter is the most favorable for several years past, and, in consequence, all available forces are concentrated at the logging camps. In anticipation of the large cut this next summer, nearly all the mills are undergoing thorough and extensive repairs, and some new ones are being built. This gives the machine shops and engine builders no end of work; all are working full force, and many are working over-time, unable to get enough mechanics.

The shops in the Saginaw Valley are equally busy on repair work and saw-mill machinery.

Wickes Bros., of East Saginaw, are crowded with orders for their steam gangs, have orders for three months ahead.

The Lansing Iron Works are unable to fill their orders for their new portable saw-mill, which embraces several valuable improvements. They also have stock on hand for twenty farm engines.

The Allis Engine Works, of Milwaukee, have orders for months ahead. They are working a force of 600 men, and for the past eighteen months have worked fifty men on the night force. The works are now engaged on large engines of novel design for saw mills, having cylinders 34″ × 56″. These are among the largest horizontal engines built, having the improved Corliss valve movements. Besides some large marine engines and their standard flouring mill engines, which are turning out 100 barrels of flour per gross ton of coal, banking included, they are building a pumping engine for Milwaukee, with a capacity of twelve million gallons, having been awarded the contract over well-known Eastern rivals. This firm are getting much better prices than one year ago, and are still obliged to refuse orders; their pay roll amounts to $35,000 per month.

Wilson & Hendrie, of Montague, Mich., are building some large-sized mill engines, also an improved direct steam gang, embodying some original ideas.

Rodgers Bros., Muskegon, Mich., report business good, and intend going into the manufacture of the Dixon steam pump quite largely the coming spring.

The Grand Rapids shops are full of work.

A. Leitelt & Co. are building some large engines for gang mills. Butterworth & Lowe are also building large engines with new design of bed, and have recently applied to one of them a Cummer automatic cut-off.

Whiting Bros. Manufacturing Company, Cedar Rapids, Iowa, began January 1, 1881, to do a general machine shop and foundry business. Have a brick building 40x80 feet, and employ fifteen men.

Niles Tool Works, Hamilton, Ohio, write us:

The volume of our business has grown to such an extent as to tax our facilities to the utmost, although we have largely added to them within the last year. We have now under contract, to be erected as soon as the weather permits, shop buildings of considerable magnitude, which, when equipped, will help us to keep pace with our orders. We have every assurance of a very busy year.

It is probable that St. Louis, says the *Railway Register*, will soon have the locomotive works suggested in our last number. Advertisements calling for proposals from real estate owners of from twenty to thirty acres of land, suitably located for the purpose of works of this character, have appeared in the city papers. The works are designed to have a capacity of 500 locomotives per annum, and will give employment to over 2000 operatives. The new company will have a capital of two and a half millions, and the buildings will be constructed in the most substantial manner possible. The works will probably be in operation within six months, and we are confident that they will be successful and profitable.

The Louisville Car Wheel Company will nearly double their capacity by enlarging their works.

## Machinists' and Engineers' Supplies.

NEW YORK, Feb. 3, 1881.

Business is generally good, but is somewhat retarded by the extremely cold weather. As a rule, prices are steady. The Raymond Mfg. Co., New York, have just issued a new explanatory circular of their patent non-conducting coverings for pipes, steam boilers, etc. It will be mailed to any one upon application. J. Stevens & Co., Chicopee Falls, Mass., will shortly bring out a new style of cutting nippers. The tool will cut readily with but little effort, will be well made, durable, and will be sold at a reasonable price. The same firm has issued a small illustrated price list of their specialties (small tools) for machinists. Kearney & Foot, 78 Chambers street, New York, print on a card, 10″x12″, "Instructions on the Use of Files," which they will mail to any one, together with their new catalogue of files on receipt of 27 cents in stamps. James Mahony, 5 Bowling Green, New York, is introducing a new gas-consuming furnace for boilers, which is very easily applied to boilers already in use. It has been practically tested with excellent results.

## Iron and Metal Review.

NEW YORK, February 3, 1881.

Pig iron is very regular as regards price and demand. No. 1, Foundry, $25; No. 2, $22 and forge $20; Old T rails can not be obtained at less than $28.50 per ton; Bar iron from store is steady on the basis of 2.5c. for refined; Boiler plates are, as usual in Feb., a little weaker, though the probability is they will be not only stronger but somewhat advanced in price next month. We quote: Tank, 3c.; Refined, 3¼c.; Shell, 3¾c.; Flange, 4¾c.; Firebox, 5½c. Boiler tubes are selling at 40 per cent. discount from list.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following to-day:

The metal market has been without especial change during the last week. London quotes Straits Tin, £91, 10s., Singapore, $28¾c. Transactions confined principally to home market. We would quote spot, nominally, Banca Tin, 25c.; Malacca and Straits 20¾c. to 21c.; Billiton, Australian and "Lamb & Flag," 20½c. to 20¾c.; Bar Tin, 22c.; Pig Lead, 5c. to 5¼c., as to lots, market firm. Antimony, 15c. to 16c.; Spelter, 5½c. for Domestic; 8c. for "Bertha," pure; Solder No. 1, 11½c.; "Half and Half," 13½c.; Bismuth, $2.50.

## WANTED

Wanted—A practical machinist of large and varied experience, wishes a situation where a good steady man is wanted. Is used to Press and Die work, also to the charge of Help. Address MACHINIST, 89 North Avenue, Cambridge, Mass.

Wanted—A draughtsman, with nine years experience in the office of a prominent hydraulic engineer, and capable of taking charge of outside work, desires a permanent position. Address W. W., Box 2013, New York, P. O.

Wanted.—Several First-Class Wood Pattern Makers at once. The Norwalk Iron Works Co., South Norwalk, Ct.

Wanted—Draughtsman—A good Mechanical Draughtsman, having an extended experience desires work during part of the day or evening. Address M. C., office of the AMERICAN MACHINIST.

Wanted—First-class Mechanical Draughtsman desires employment. Thorough Mechanician. Bright on Specials, Machinery and Tools. No objection to any part of the country, except Alaska. A.C.C., care AMERICAN MACHINIST, 96 Fulton Street, N. Y.

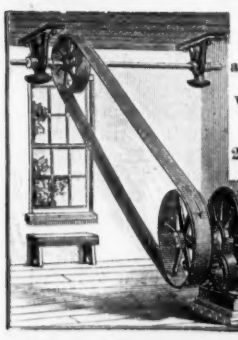
Foreman for engine and general machine shop, employing from 35 to 50 hands wanted in Canada, where engines are built from 15 to 120 horse power. None but a thoroughly competent man, who understands the handling of tools, need address, Manufacturer, AMERICAN MACHINIST office.

Wanted—Lathe 36″, 16′ bed, Screw Cutting. Second hand preferred. Plain Lathe 30″ to 36″ Swing 15′ bed. Bowman Machine Co., 703 Market St., St. Louis, Mo.

Wanted.—A position as engineer of high or low pressure land engines. Best references. Address, J. C. D., 228 W. 1st St., Oswego, N. Y.

Wanted.—An experienced Machine Tool Draughtsman with prospect of permanent situation at good wages. Address, stating experience, salary desired, &c., "Tool Shop" care AMERICAN MACHINIST.


THE
BAKER BLOWER



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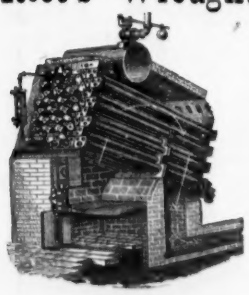

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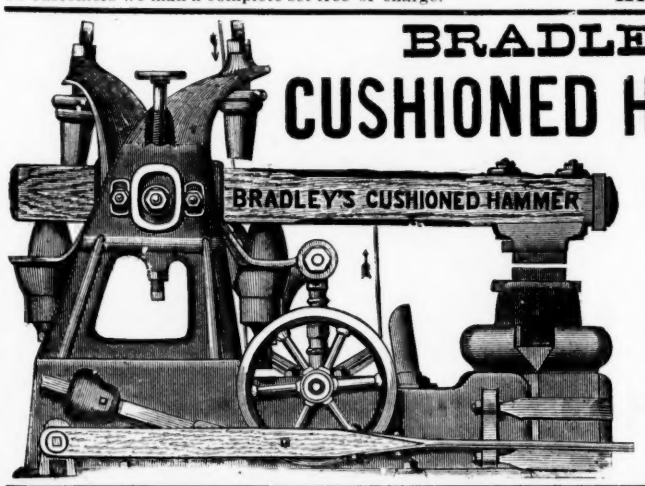


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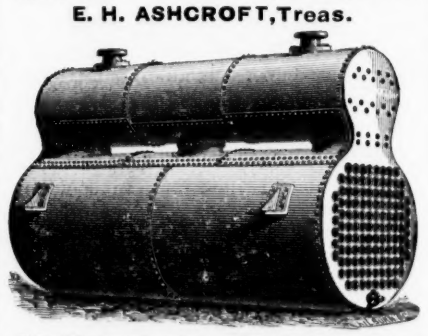

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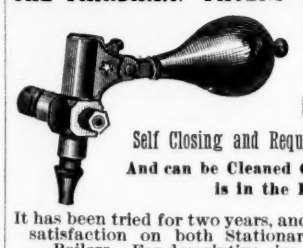

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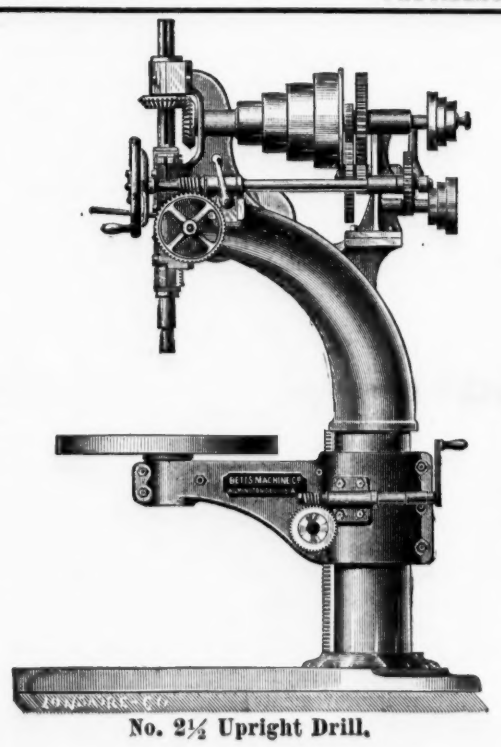

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